Final Environmental Impact Statement for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes

United States Environmental Protection Agency

Region 9

San Francisco, California

EPA

FINAL
ENVIRONMENTAL IMPACT STATEMENT

FOR THE DESIGNATION
OF AN OCEAN DISPOSAL SITE FOR FISH CANNERY WASTES
OFF TUTUILA ISLAND, AMERICAN SAMOA

U.S. Environmental Protection Agency
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FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE DESIGNATION OF AN OCEAN DISPOSAL SITE FOR FISH CANNERY WASTES OFF TUTUILA ISLAND, AMERICAN SAMOA

Environmental Protection Agency
Region 9 San Francisco, California

Comments must be received no later than ________________ 1989, which is 30 days after the publication of the Notice of Availablilty in the Federal Register. Comments should be addressed to and copies of the FEIS may be obtained from:

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Executive Secretary,
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Pago Pago, American Samoa 96799

Office of Environmental
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U.S. Fish and Wildlife Service
300 Ala Moana Boulevard
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Southwest Fisheries Center
Honolulu Laboratory
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APPROVED and SUBMITTED BY: John Wise
for Daniel W. McGovern
Regional Administrator

Date 2.3.89

ABSTRACT

In accordance with the National Environmental Policy Act (NEPA) and the regulations of the United States Environmental Protection Agency (EPA), this **Final** Environmental Impact Statement (FEIS) has been prepared for the designation of an ocean disposal site for fish cannery wastes off Tutuila Island, American Samoa. The purpose of the proposed action is to provide an environmentally acceptable alternative for the disposal of waste materials from the processing of fish at the Star-Kist Samoa Incorporated and Samoa Packing Company plants located at Anua, on Pago Pago Harbor, Tutuila Island. Waste materials include Dissolved Air Flotation (DAF) sludge, precooker water, and press water.

The ocean based alternatives discussed include the present site designated in 1987 under Ocean Dumping Permit OD86-01 at 170°40'52" **West** longitude by 14°22'11" South latitude (equals 170°40.87' W by 14°22.18' S on NOAA Navigation Chart 83484). This site is in about 910 fms (1664 m; 5460 ft), about 2.55 n mi from land. A shallower site south of Taema Bank about 2.3 n mi offshore in 120 fms (220 m; 720 ft) and a more distant site about **4.85** n mi offshore at 1302 fms (2381 m; 7812 ft) **were** also considered in the DEIS. No preferred site was selected in the DEIS. **With input from federal and local agencies and the public, EPA has selected the deeper water site, with the center moved seaward to a point 5.45 n mi offshore in 1502 fms (10.08 kms, 9012 ft), as discussed herein.**

Land based alternatives that were examined in the DEIS included the sites previously used for sludge wastes on Tafuna plains, and the landfill near Futiga used for sludge and, in emergencies, for solid fish scrap and grit. The American Samoa Government (ASG) has expressed strong opposition to any land dumping; sludge disposal on land stopped in 1980, and a preliminary injunction was granted on 21 March 1986 to halt the emergency disposal of fish scrap, offal or waste on land. The problems include human health hazards, the potential for water contamination, limited available land for all uses, the communal system of land ownership, and esthetics such as odors and traffic congestion.

The no **action** alternative would place the canners in violation of EPA and ASG **regulations**, and cause degradation of land, water supplies or Pago Pago **Harbor**.

Changes in the text of the FEIS, including selection of the preferred site and input from comments, are printed in bold face.

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SUMMARY

This Final Environmental Impact Statement (FEIS) evaluates the environmental effects of designating an ocean disposal site for fish processing wastes off Tutuila Island, outside of the United States Territory of American Samoa.

S.a. EXISTING PROBLEM

American Samoa consists of several islands: the main island of Tutuila, plus tiny Aunu'u Island and the Manua group, Ofu, Olosega and Tau Islands, which are all part of a volcanic chain, as well as Rose Atoll to the east and Swains Island to the north. Located about 2600 mi (4160 km) south southwest of the Hawaiian Islands (Figure S.1), Tutuila is the largest of the American Samoa Islands. The principal village, Pago Pago (pronounced "Pango Pango") lies at 14°15.6' South latitude and 170°42.18' West longitude on Pago Pago Harbor; the adjacent town of Fagatogo ("Fangatongo") is the administrative center.

The urban area and villages lie primarily around the margins of the harbor, and have spread along the narrow south shore of the island or up the lower slopes on the south side of the mountains. Other habitation is limited by the steep terrain on most of the rest of the island and by coastal cliffs to tiny villages which lack access by paved roads; a few villages are accessible only by boat (Figure S.2). Tutuila Island is 19 mi (31 km) long from Cape Taputapu to (Cape) Matatulu and about 6 mi (9.6 km) wide at the widest place at Steps Pt. narrowing to about 1 mi (1.6 km) at inner Pago Pago Harbor and at several places to the east. Road distance is 36 mi (58 km) to travel the length of the island.

Fish processors have been located in Pago Pago Harbor since World War II U.S. Navy installations were converted into a tuna processing

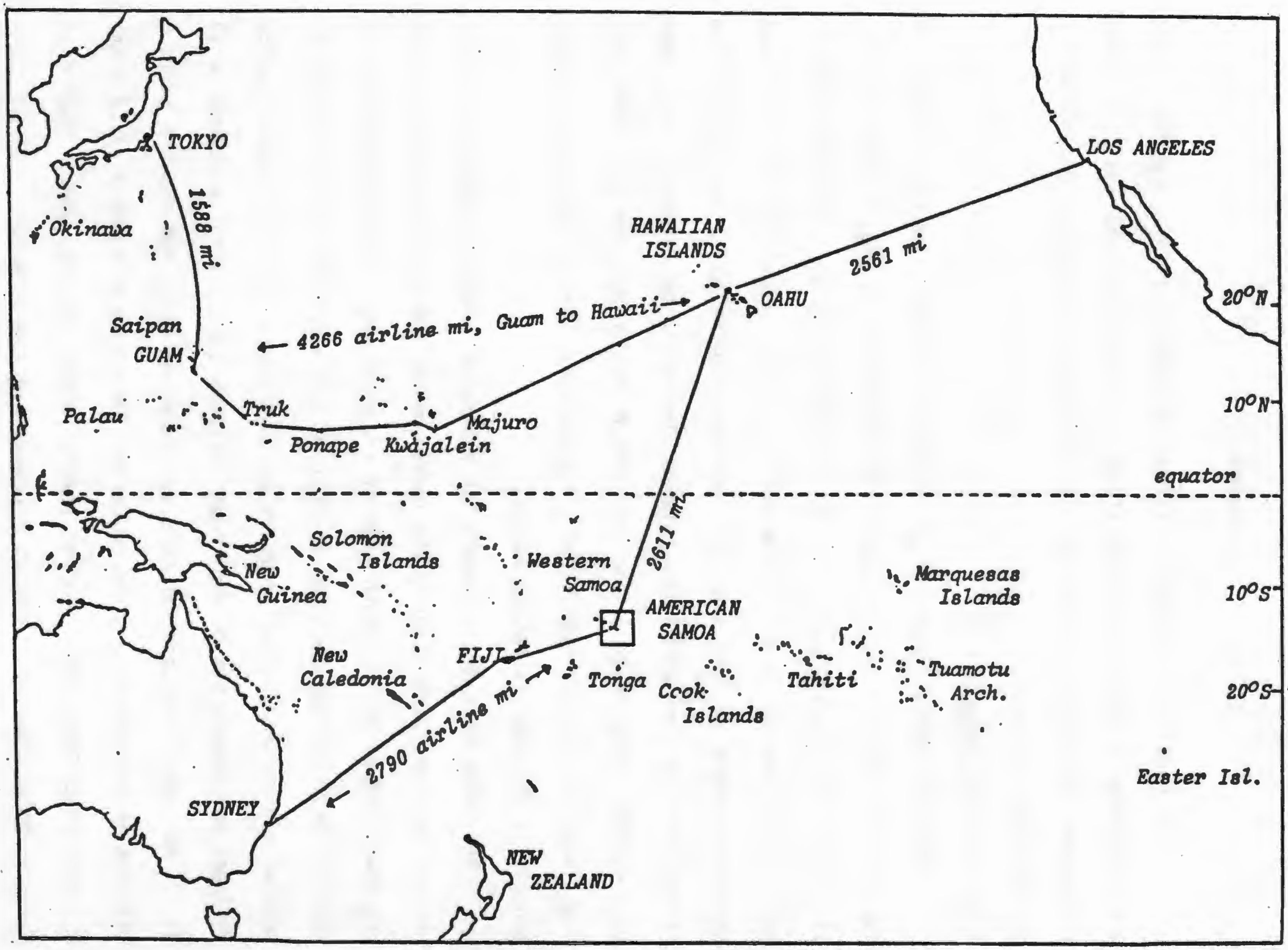

Figure S.1. Location of the proposed action in American Samoa.

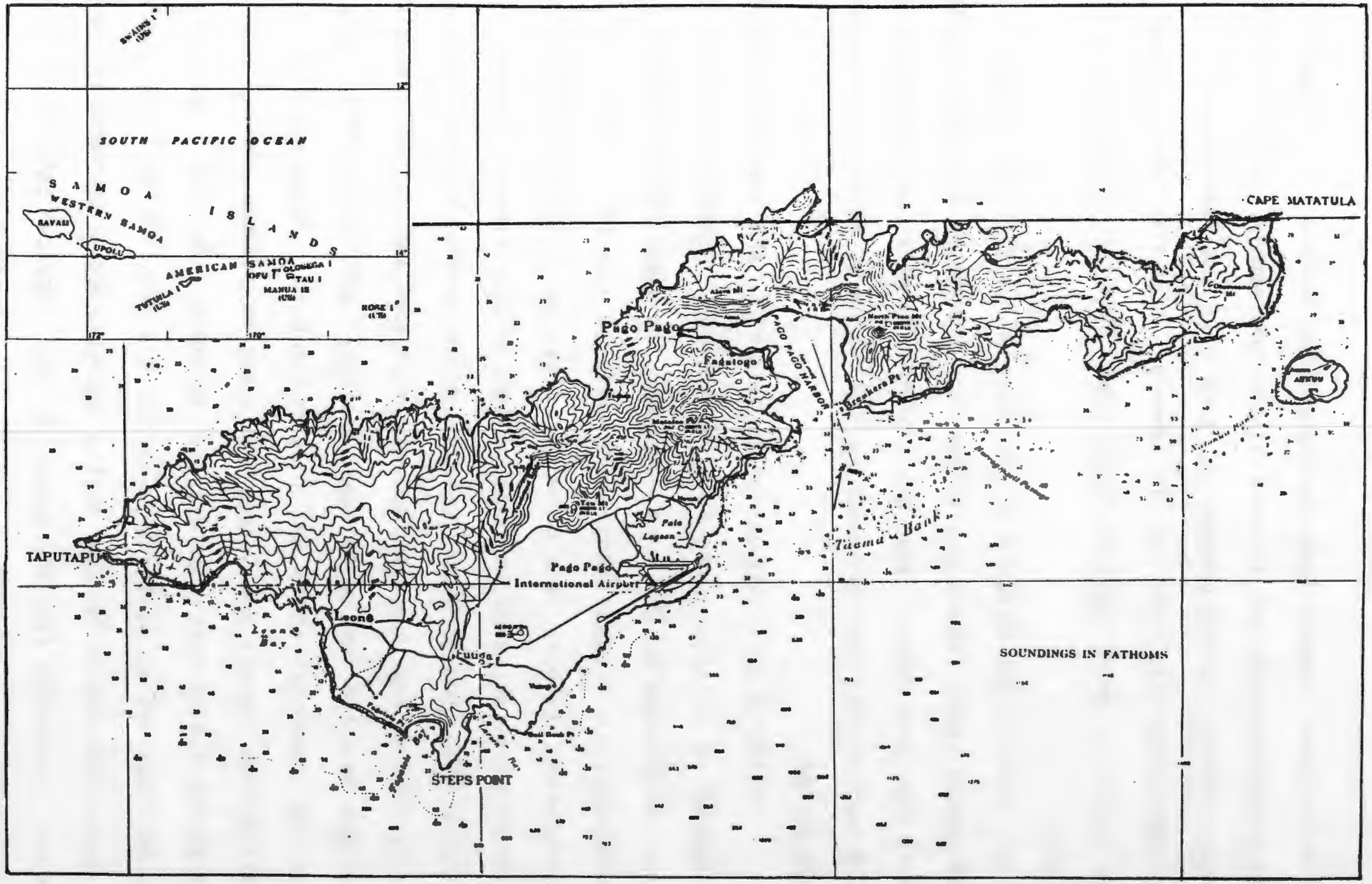

Figure S.2. Tutuila Island, American Samoa (inset, the Samoan Islands).

facility under funding from the Rockefeller Foundation. It operated only as a pilot project and lacked a viable tuna supply. Van Camp Seafoods, now a Ralston Purina enterprise, took over the facility in 1953, and presently operates Samoa Packing Company. Star-Kist Foods, a subsidiary of the H. J. Heinz Company, opened their Star-Kist Samoa, Inc. plant in 1963.

Prior to the installation of Dissolved Air Flotation treatment (DAF) of wastes, both liquids and solids from processing tuna were discharged into Pago Pago Harbor. When pet food and fishmeal operations were added, the particulates were screened out for recovery, reducing the impact on the Harbor.

Following DAF installation in 1974-1975, the resultant sludge was disposed of on land, since this was the only alternative thought to be legally feasible at that time. However, the steep volcanic terrain which predominates in American Samoa, and the dearth of level land for habitation, farming, and commerce, plus the porosity of the soils at potential sites, made location of land disposal facilities difficult. The materials had to be trucked through the principal urban areas, within a few feet of American Samoa Government offices and the Fono (legislature) on the only two lane paved road, creating odor and traffic complaints. At the dumpsites there was insufficient soil to cover the wastes, attracting insects and vermin and creating noxious odors, as well as creating a site that was hazardous to human life. The life threatening conditions led to deaths of a child, his dog, and an adult trying to rescue them, due to hydrogen sulfide asphyxia and/or drowning in the waste pond. Complaints from the public and the American Samoa Government led the EPA to issue a permit for ocean disposal off Tutuila Island in 1980.

S.b. DESCRIPTION OF ALTERNATIVES

S.b.1. PRESENT DUMPSITE

The present alternative for existing levels of waste dumping is the ocean dumpsite described in Ocean Dumping Research Permit (OD86-01) and the Federal Register Notice of Intent to prepare a Draft Environmental Impact Statement (DEIS)(52 FR 4657, February 13, 1987). The site is at 14°22'11" South by 170°40'52" West (equals 14°22.18' S x 170°40.87' W on NOAA chart 83484) (See Figure S.3) at about 910 fathoms (fms); (1664 m; 5460 ft) depth. The center of the present dumpsite is about **2.55 nautical miles (n mi), (4.7 km) from the nearest land,** 2.25 n mi (4.16 km) from the fringing reef, and about 4.7 n mi (8.7 km) from Breakers Point, which lies seaward of the canneries by about 2 n mi (3.7 km).

From 1980 to 1986 DAF sludge was dumped by Special Permit No. OD 79-01/02. The 1.0 n mi (1 n mi = 1.85 km; 6076 ft) diameter dumpsite was then located at 14°22'00" South by 170°41'00" West, in about 800 fms (1463 m; 4800 ft) of water (45 FR 77435, November 24, 1980).

It was decided in 1986 to increase the diameter of the ocean disposal site to 1.5 n mi and move it to the south southeast by approximately 0.4 n mi into about 910 fms (1664 m; 5460 ft.), although there was no documented evidence on file that ocean-dumped wastes have reached the fringing reefs or shoreline, or endangered any habitat. The companies have increased production, and the volume of materials being dumped has risen significantly, making it prudent to move the center of the dumpsite to maintain a safe distance from the shoreline.

The new location also aided navigation by placing the center of the dumpsite on a magnetic north heading to the light at Breakers Point, on the east side of the harbor entrance. There are no navigational aid systems in American Samoa such as Loran C, and until the research permits began the dump vessel and monitoring vessels lacked radar.

Previous studies have not identified any adverse impacts from ocean disposal at the site used from 1980 to 1986. At the dilutions present in the marine environment, the material has been shown to be non-toxic to animal species and has enhanced the growth of some molluscan species in laboratory tests (Soule and Oguri, 1979a,b; 1980a,b; 1981; 1983a,b; 1984; 1986). The depth of the water and the slope of the bottom probably preclude potential enrichment of benthic fauna if any of the waste were to reach the benthos. Present specific gravity tests suggest that none of the waste material would reach the bottom, and, while no benthic sampling has been done in the area, it is unlikely that the steep rocky slopes present habitats suitable for a significant benthic population. A slight enrichment of surface waters may be beneficial to some juvenile fish and molluscs by increasing the nutrients available for microheterotrophs and zooplankton.

S.b.2. SHALLOWER WATER DUMPSITE

The 120 fm (220 m; 720 ft) contour lies about 2.3 n mi (4.26 km) seaward of the Pago Pago Harbor entrance and Breakers Point. A site at 14°20.00' South by 170°39.30' West would make a much shorter turnaround time for the dump vessel if it were a feasible site. However, the 120 fm contour is just seaward of Taema Bank, an area with diverse fish and invertebrate populations. The inner side of the Bank is heavily silted by runoff from the harbor, but bears an interesting invertebrate fauna and the outer face is quite rich. It would not be possible to have a 1 n mi diameter dumpsite at the 120 fm contour without impinging on reef habitats.

Taema Bank was, during geological history, a part of the fringing reef of a large volcano, the caldera of which included Pago Pago Harbor and the area between the airport and North Pioa (Rainmaker) Mountain. Taema Bank then became a part of a barrier reef connected to Nafanua Bank east of the harbor and fronting a larger lagoon which extended from west of Pala Lagoon to the east end of Tutuila Island, before the islands underwent submergence (U.S. Army Corps of Engineers, 1980). The old coral reefs became sunken limestone formations projecting upward as raised platforms, with living coral patch reefs formed above in shallower water.

The living coral reefs were decimated by the Crown of Thorns (*Acanthaster planci*) starfish invasion in the late 1970s. Some recovery has occurred in recent years, and Taema Bank is considered to be one of the most important habitats of the area.

Drogue studies in March 1983 (Soule and Oguri, 1984) demonstrated that a waste plume dumped over Taema Bank might travel toward Pago Pago Harbor and then would move west or southwest toward the fringing coral reefs bordering Pala Lagoon and the airport (See Figure S.3). The airport runway is constructed on coral reef and rubble fill. The reefs bordering the airport and Pala Lagoon are rich in shellfish. Drogues positioned farther offshore moved north toward Taema Bank, regardless of the direction of wind, or the current, as measured by current meters (See Section III.B.2.c. and Appendix A.1., Table A.1.)

The shallow water dumpsite alternative was not selected by EPA due to the hazards to biological resources and to navigation. Coral reefs support and shelter a variety of fish and shellfish harvested by local residents. While fish and shellfish can withstand or benefit from enrichment and some turbidity, coral reefs cannot tolerate eutrophication or

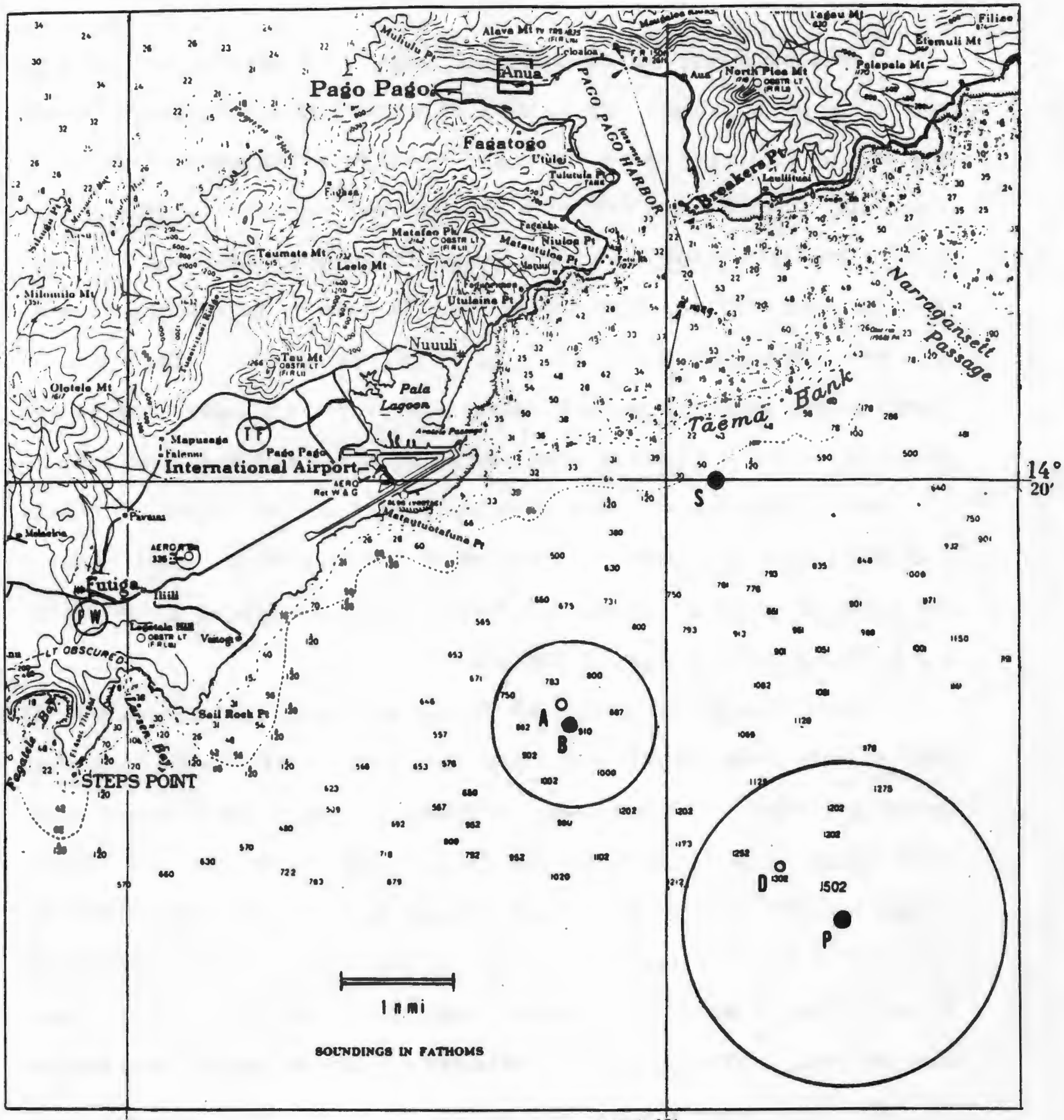

Figure S.3. Location of past, present and preferred cannery waste dumpsites.

A - Cannery waste dumpsite center, 1980-1985
B - Cannery waste dumpsite 1986- ; diameter of circle is 1.5 n mi
D - Deeper water alternative site
P - Preferred deeper water site; diameter of circle is 3 n mi
S - Shallow water alternative site
FW - Futiga land waste pit
TF - Tafunafou land waste pit
Box - Anua, location of canneries

reduced light. Death of the coral would destroy the shelter required by reef organisms, and leave the harbor area more vulnerable to storms, in addition to depleting the fauna. The proximity of habitations to a shallow water dumpsite would increase the potential for esthetic problems from the wastes due to odors or the deposition of scum or an oily slick on the beaches.

If the 120 fm contour in the channel between Taema Bank and the airport were to be used as a dumpsite, it would also be a hazard to the navigation of other vessels in and out of the port. Passage across Taema bank might be risky, since it has a depth of about 4 fms (7.3 m; 24 ft.) and the bank creates heavy breakers because of the rapid change in depth from 100 fms to 4 fms in less than 0.5 n mi. During storms, vessels the size of the dumping vessel can take an hour or more to make their way out of that area.

S.b.3. DEEPER WATER DUMPSITE:THE PREFERRED SITE

An area 8.1 n mi (14.98 km) south southeast of Breakers Point and 5.16 n mi (9.55 km) from the nearest fringing reef at 14^{o}24.00' South by 170^{o}38.30' West has been selected as the preferred site, based on recommendations from public agencies that reviewed the DEIS. The center has been moved seaward about 0.74 n mi from that discussed in the DEIS, but the characteristics are essentially the same. The site has a depth of 1502 fms (2746 m; 9012 ft), according to NOAA Navigation Chart No. 83484. This site is about 3.2 n mi, (5.92 km) farther from shore than the present site, placing it outside Territorial waters. This permits enlarging the site to a diameter of 3 n mi, which allows the wastes to dissipate within the site (see Appendix B). It is not possible to enlarge the present dumpsite without encroaching on reefs and shoreline. There are minor drawbacks to this site. Navigation by sextant and sighting compass are more difficult at the greater distance, especially during the frequent rain squalls or storms. Radar, which was installed on the dump and monitoring vessels, is not sufficiently accurate to position closely spaced monitoring stations. The distance to be traveled by the dump vessel would be about 10.1 n mi (18.7 km) from the docks, increasing the time required for the disposal and for monitoring vessels if used, to be at sea. The present research monitoring program requires overtime to perform, and this site would extend that time.

The nature of the benthos at this site is unknown, but is too deep to benefit from any potential enrichment from the wastes. The wastes are largely confined to the upper 20 m of the water column. Enrichment of the water column would probably not benefit the standing stock of the tropical deep sea waters, which are known to have a very low productivity, nor would the wastes reach the shallower waters which could support higher productivity.

The deeper ocean site must be considered as the preferred site if the processors increase quantities dumped. The waste quantities allowed in the research permit are more than ten times the present vessel capacity. The canners have indicated that the daily maximum quantities included in the research permit do not represent anticipated production quantities, and would never be expected to be generated continually. Rather, they are volumes which might be dumped under emergency conditions over a few days should there be an unavoidable interruption of dumping activity. However, the canners may add press water and precooker water not treated by dissolved air flotation for ocean disposal, which would dilute the sludge while increasing total gallonage. These liquid wastes were defined and included in the present permit. They will be included in the special permit to be issued in March 1989.

S.b.4. LAND BASED ALTERNATIVES

The land based alternatives include ponding and landfill operations at the sites previously used, or similar sites on Tutuila Island. The steep mountain terrain severely limits the urban areas available for business, commerce, industry and housing, as well as limiting land for food production. Plots for communal gardens and pig raising are often on steep slopes. The island is so precipitous that paved roads are almost all along the south shore, crossing lava benches and fringing reefs. Previous attempts to maintain sludge ponds have engendered citizen complaints over odors, insects, and vermin; the lack of available soil to cover a landfill operation precluded ameliorating such complaints. The death of a child who tried to rescue a dog from a pond, as well as the death of an adult who attempted to rescue the child, greatly escalated citizen protests.

Percolation of saline cannery wastes into the limited ground water was an unacceptable problem on the Tafuna Plains (Tafunafou) site. The Tafuna site is about 1 mi (1.6 km) northwest of the west end of the airport runway. At a pond near Futiga, on one occasion, collapse of the earth barrier due to saturation caused release of the wastes into Larsen Bay, polluting the shore and fringing reef habitats. Futiga (pronounced "Futinga") is about 0.6 mi (1 km) inland from Larsen Bay and about 1 mi (1.6 km) inland from the National Marine Sanctuary at Fagatele Bay.

There are no other land based sites available, and land dumping is not acceptable to the American Samoa Government. However, if other similar sites were available, they would be subject to the same problems, and create the same grounds for opposition: scarcity of available level land for all uses, creation of nuisance odors, attraction of vermin, hazards to life and health, and pollution of groundwater supplies.

Other alternatives which have been examined in the past include changes in waste treatment processes that have been tested or reviewed at various plants in recent years, such as centrifuges, belt presses, vacuum filter presses, anaerobic treatment and digestion of sludge and other byproduct usages. These are discussed in detail in Section II.A.5, under Other Appropriate Alternatives.

S.c. MAJOR CONCLUSIONS

Ocean disposal is the only viable alternative for disposing of the cannery wastes in American Samoa. Land disposal has already proved to be unsatisfactory to the residents and to the American Samoa Government (ASG). Designation of a permanent disposal site is required in order to allow continued ocean disposal under renewable special ocean dumping permits. If the canneries ceased to utilize their dissolved air flotation (DAF) equipment, eliminating production of sludge, the increase in organic loading of their harbor effluents would place them in violation of their NPDES permits (AS-0000019, AS0000027), as well as EPA and ASG water quality standards. Fish products constitute over 98% of the exports from American Samoa (ASG, 1981) and the canners are by far the largest private employer on Tutuila Island. The ASG provides more than 50% of the employment, subsidized heavily by the U.S. Government through grants and contracts. In addition, Social Security and veteran's benefits support a substantial population. Removal of the only significant private employment, mostly of unskilled labor, would destroy the economy of American Samoa and impact Western Samoa.

CHAPTER 1 INTRODUCTION

I.A. GENERAL INTRODUCTION

I.A.1. THE SAMOAN ISLANDS

The islands of Samoa are part of the Samoan Ridge, a deep water volcanic archipelago trending northwest to southeast some 2600 mi (4160 km) south-southwest of the Hawaiian Islands (Figure I.1). Volcanic peaks rise steeply from the ocean floor to elevations of up to 931 m (3056 ft) above sea level. The larger, more western islands of Savai'i and 'Upolu belong to Western Samoa, an independent country. The more eastern islands of Tutuila, Aunu'u, and Ofu, Olosega and Ta'u Islands in the Manu'a group, form the United States Territory of American Samoa, along with Rose Island, an uninhabited coral atoll which serves as a National Wildlife Refuge and nature reserve 160 miles to the east. Swains Island, a coral atoll 230 miles to the north, is administered by the American Samoa Government (ASG) but is geographically part of the Tokelau Islands. The principal village of American Samoa is Pago Pago, but the administrative center is nearby in Fagatogo, both located on Pago Pago Harbor, on Tutuila Island.

There are remains of several volcanic calderas, some of which are drowned and form coastal embayments such as the National Marine Sanctuary at Fagatele Bay. Pago Pago Harbor is part of a very large, partially drowned caldera which has been eroded by riverine flow on the northwest end and is open to the sea on the south (American Samoa Department of Public Works, 1976). The harbor was once part of a larger lagoon that included a much larger Pala Lagoon and the area inshore of Taema and Nafanua Banks, then part of an extensive barrier reef. Changes in sea level have reduced the size of the islands, and separated Tutuila from

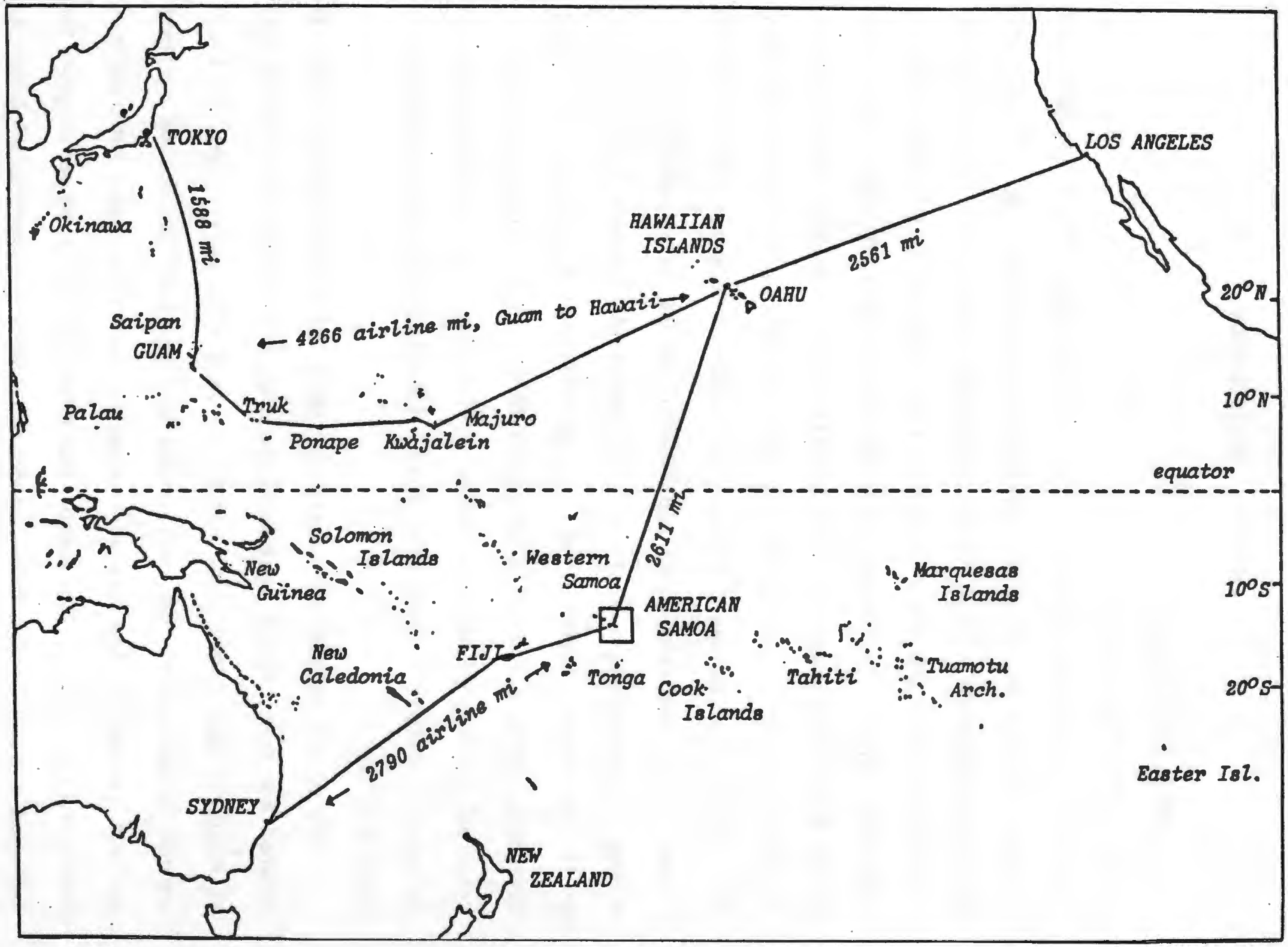

Figure I.1. Location of the Proposed Action in American Samoa

Aunu'u. Pago Pago Harbor has roughly the configuration of a bird's head, with the capital and associated villages located on the narrow, margins of the harbor, surrounded by steeply rising peaks (Figure I.2).

I.A.2. POLITICAL HISTORY

The Dutch navigators were the first Europeans to contact the Samoan Islands, in the 1700s, but the tropical Pacific Islands later became a focus of the major European power struggles for territory. Tutuila Island was sought in 1872 as a coaling station for the U. S. Navy Pacific fleet, because of its deep water port and strategic location. Germany also had a strong presence in the Samoan Islands at that time, as did Britain. An agreement in 1899 resulted in division of the Samoan Islands; those beyond the 171st meridian became Western Samoa, a German protectorate, and the Kingdom of Tonga, a British protectorate, while islands east of the 171st meridian became American Samoa, an American protectorate. Germany lost its Pacific presence to Great Britain after World War I.

The U.S. Navy administered American Samoa until 1951, when the Navy closed its base there and administration was turned over to the U.S. Department of Interior (DOI). A constitution for the unincorporated territory setting up three branches, the executive, legislative and judicial, was approved in 1960. DOI appointed the Governor until 1977, and the first elected Governor took office in 1978 [U.S. Army Corps of Engineers (USACOE), 1979; American Samoa Government, 1981a].

I.A.3. PAGO PAGO HARBOR FISH CANNERIES

Fish processors in American Samoa have been located along the "upper beak" of the bird's head, at Anua (Figure I.2) since shortly after World War II, when the U. S. Naval Station was closed. Part of a naval facility was converted into a tuna processing facility as a pilot project of the

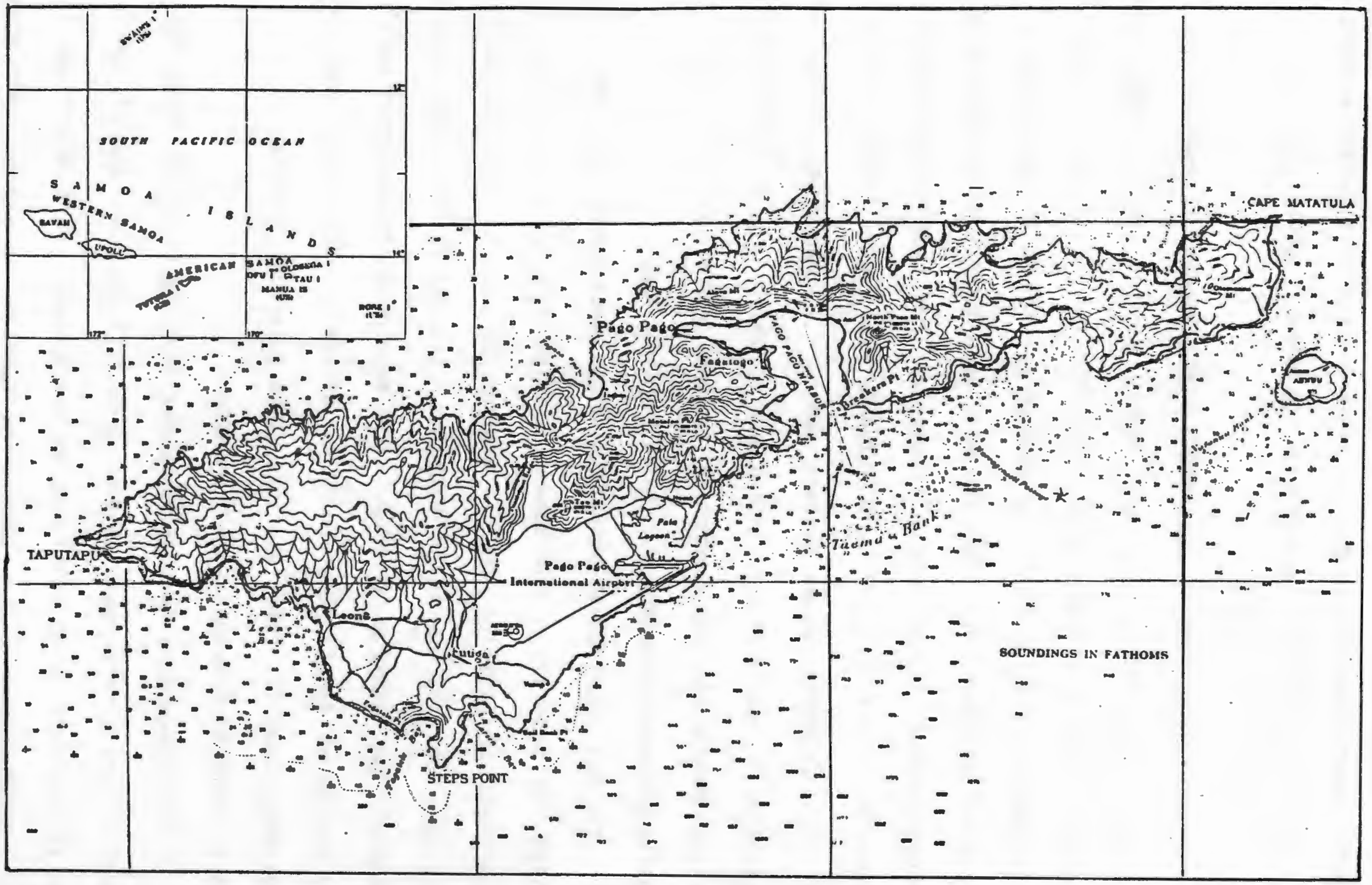

Figure I.2. Tutuila Island, American Samoa (inset, the Samoan Islands).

Rockefeller Foundation, but the lack of an American vessel tuna supply prevented development. After the U.S. Bureau of Customs ruled that foreign flag vessels could land fish there, Van Camp took over the facility in 1954. Star-Kist started operation in 1963 (pers. comm., Vincent Evich, now retired from Star-Kist; Schug and Galea'i, 1987).

Fish scrap and offal were formerly dumped into the harbor, and attracted many fish and sharks prior to the installation of fish meal processing equipment, which removed the screenable particulates and ended the shark menace. Today, liquid wastes continue to flow into the harbor under NPDES permits.

I.A.4. HARBOR ECOLOGY

In spite of pollution problems, fish are still caught in the inner and outer harbor by fish weirs, throw nets, rod and reel, hook and line and gleaning (the harvesting of shellfish and fish by hand intertidally); shellfish are abundant in several harbor localities. Whale Rock, in the outer harbor, and Toasa Rock are excellent diving locations for reef fish and invertebrates. Removal of all wastes may result in a significant change in the harbor biota (Soule and Oguri, 1983b,c). **The harbor has also undergone significant change due to physical alterations and other urban impacts.**

Inner Pago Pago Harbor is poorly flushed, due in part to its depth, to past uncoordinated land reclamation projects (USACOE, 1979), and to the natural partial sill configuration near the harbor entrance. **Although there is regular trash collection, refuse sometimes accumulates** in the small streams that lead into the harbor, or into the harbor itself. Debris and leaves from the heavy vegetation on the steep hillsides are flushed into the harbor by the torrential tropical rains.

The island receives more than 125 inches of rainfall annually, according to weather records from the Tafuna airport. However, the inner harbor receives more, perhaps up to 200 inches, because it lies in the lee of Pioa (Rainmaker) Mountain east of the canneries, and up to 300 inches falls at Tau Mountain west of the harbor (ASG, 1981d). Runoff sometimes creates a temporary freshwater lens on the surface of the harbor and coastal waters, becoming a limiting factor to some species.

Additional adverse impacts on the harbor have included fuels. During coaling station days, from the 1890s to 1922 coal dust was blown and washed into the harbor, turning waters black. Oil spills have been common, associated with the need to import all fuel and with careless handling. In 1980-81 over 10,000 gals of oil were spilled into the harbor (ASG, 1981). The old Japanese, Taiwanese, and Korean longline fishing vessels, which are less common now than in the past, are generally so poorly maintained that oil slicks have often been present in the harbor.

I.A.5. PRODUCTION OF DISSOLVED AIR FLOTATION SLUDGE

The imposition of regulatory controls on cannery wastes followed the sequence of requirements under the National Environmental Policy Act (NEPA) in 1970 and the Federal Water Pollution Control Act (FWPCA) Amendments of 1972. The Dissolved Air Flotation (DAF) process, introduced for tuna waste treatment in 1974 under a requirement of the National Pollution Discharge Elimination System (NPDES) permit program, greatly reduced the organic loading of the liquid waste effluent into the harbor. However, it created a different problem because the DAF process produces quantities of semi-solid, odoriferous, saline sludge (about the consistency of rotten cottage cheese) which is high in fats, and proteins and contains various chemical coagulants such as aluminum ammonium sulfate and polymers.

Policy of the U.S. Environmental Protection Agency at the time of DAF installation precluded ocean disposal of the sludge material, and mandated land disposal. Whereas untreated fish wastes can be dumped at sea without a permit the interpretation by EPA Region 9 was that DAF wastes could not be dumped without a permit, because EPA determined that the waste "may reasonably be anticipated to endanger health, the environment or ecological systems" [40 CFR 220.1(C)(ii)].

I.A.6. LAND DISPOSAL OF DAF SLUDGE

As in other tropical island localities, particularly high islands of volcanic origin, there is very little land for habitation and cultivation on the peripheral shoreline and fringing reef structures. The Tafuna Plains, northwest of the airport, is the only mostly undeveloped level land on Tutuila Island. The disposal site for Van Camp (now Samoa Packing) was at Tafunafou. The porous nature of the upper soil underlain by lava bench, and associated problems with percolation, in an area near the island wells made that an undesirable site, although earlier allegations of high nitrogen in ground water turned out to be due to faulty laboratory data. The road built by the canners to serve the dumpsite northwest of the airport runway was immediately used by land owners to subdivide property and build housing. This was shortly followed by complaints of odors, flies and other negative factors.

Star-Kist Samoa built a sludge dump in hilly terrain near Futiga ("Futinga") by diking off a ravine. There an earth dike finally gave way due to saturation and released the impounded wastes into Larsen Bay where it polluted the shore until carried away by vigorous wave action in the area. Such hazards make land based disposal a significant problem for

American Samoa.

Land disposal of the odoriferous wet DAF sludge was objectionable to nearby residents and attracted vermin, while the lack of soil to cover the waste created health hazards, including toxic hydrogen sulfide gas, which culminated in the deaths of a child trying to rescue a dog from the morass and of an adult who attempted to rescue the child (V. Evich, pers.comm.).

The DAF wastes had to be trucked from the canneries on the north side of the harbor along the narrow road that passes through the business and commerce areas and past the legislature building, convention center, the resort hotel, government offices, hospital and residences. When the disposal truck broke down opposite the legislature (Fono) on one occasion, there was not a tow truck on the island adequate to move it, and the tanker sat in the hot sun until unloaded, further antagonizing the population and emphasizing the demand for an ocean disposal alternative.

The ASG has consistently opposed any type of terrestrial dumping of cannery wastes for many years, and desired ocean disposal. A News Bulletin published by the Office of Samoa Information on September 19, 1980 contained the following statement:

According to Mr. Pati Faiai, Executive Secretary for the Governor's Environmental Quality Commission, "...the issuance of the ocean dumping permits indicates that this longstanding problem which has offended many of our citizens will be finally resolved in the near future."

Governor Coleman also expressed pleasure at this development. "I am pleased that this source of irritation for many of our people is finally being rectified," said the Governor, "and I wish to thank the canneries for their cooperation in helping to promote the general welfare of the public."

In a letter to Star-Kist Samoa on May 14, 1986, the Assistant Attorney General, Ms. Phyllis A. Coven stated:

"...The government's position against land disposal of fishwastes at the Futiga Landfill or elsewhere remains firm. ...".

The entire text of the News Bulletin, and correspondence which indicate the ASG policy against terrestrial waste dumping and approval of ocean dumping, are contained in Appendix D.

I.A.7. INTERIM SITE DESIGNATION

In accordance with provisions of the Marine Protection, Research and Sanctuaries Act of 1972 (PL 92-532, 33 U.S.C. 1401 et seq.), permit No. OD 79-01/02 was issued jointly to Star-Kist Samoa and the Van Camp Seafood Division of the Ralston Purina Co. An interim site was designated by the Environmental Protection Agency for a three year period (45 FR 77435, November 24, 1980).

As stated therein, under 40 CFR Part 228.12, Ocean dumping:

> "...EPA today designates a fish cannery waste site in the Pacific Ocean as an EPA approved interim ocean site. This action is necessary to provide a site for the dumping of fish cannery waste originating in American Samoa which can no longer be accommodated on land...."

The site designated lay off Tutuila Island, American Samoa, in the South Pacific at 170°41'00" W and 14°22'00" S, the center of a 1 nautical mile diameter dumpsite (40 CFR 228.12, above). Use of the dumpsite began in December 1980.

Transportation of the wastes to the dumpsite was by the converted motor vessel *Misimoa* which had a capacity of 41,000 gals (155,202 liters) and discharged through hull ports forward of the propellers at a rate no greater than 500 gallons per minute (gpm) when moving at 5 knots.

The application for permit and site selection included items of information required at 40 CFR 221 (Soule and Oguri, 1983a Appendix). Issuance of the interim site designation was based in part on data contained in "Evaluation of Ocean Disposal of Cannery Sludge", prepared for Star-Kist Foods, Inc. and the Ralston Purina Co., by M & E Pacific, Inc. (1979). The M&E Pacific report contained data on Pago Pago Harbor, the Tafuna sewage treatment plant outfall, and adjacent open coastal waters much closer to shore than the dumpsite area. In addition, responses to the criteria for site selection listed at 40 CFR 228.5 and 228.6 were filed with EPA Region IX by letter (Soule and Oguri, 1983a, Appendix C).

I.A.8. RESEARCH UNDER THE INTERIM SITE DESIGNATION

Among the conditions of the interim site designation and permit were the analysis of wastes and performance of monitoring during the three year period. The National Oceanographic and Atmospheric Administration (NOAA) Office of Marine Pollution Assessment was interested in the ocean disposal of fish processing wastes as a generic problem, and agreed to fund investigations of the fate and effects of such wastes. Matching effort was provided by Star-Kist Foods for studies off Los Angeles and by Star-Kist and Van Camp Seafoods for those off American Samoa. Field investigations were conducted off American Samoa in January 18-21, 1982, July 20-23, 1982, and on March 23-28, 1983. Results are detailed in Soule and Oguri (1982, 1983a,b and 1984). The National Marine Fisheries Service (NMFS) funded additional studies on fish processing wastes, including the use of ammonia as a tracer of the dump plume, as reported by Soule and Oguri, 1986.

I.A.9. APPLICATION FOR RENEWAL OF PERMIT

The 1982 research in American Samoa was used as part of an application for renewal of the permit in 1983. That application was not acted upon because the generic problems of permits for ocean dumping were considered by EPA. Ocean disposal of the fish cannery wastes continued after expiration date of the original permit, with the approval of EPA Region 9.

A Marine Protection, Research and Sanctuaries Act Ocean Dumping Permit, No. OD 86-01 for Research, was issued to Star-Kist Samoa, Inc. and Samoa Packing Co effective February 26, 1987 for six months, to August 26, 1987. As a result of the applicants' request the dumpsite was enlarged to a diameter of 1.5 n mi at 170°40.87' W longitude by 14°22.18' S latitude. Research Permit OD 87-01 was issued on September 2, 1987, effective to March 2, 1988, Permit OD-88-01 was issued in March 12 1988 for another six month period, and Permit OD-88-02 (see Appendix C) was issued for the period of September 1988 through March 1989. The *Misimoa* was replaced by the MV *Azuma Maru* and subsequently the MV *Mataora*, both with similar hold capacities of 24,000 gals.

I.B. PROPOSED ACTION

The research permits were designed to identify potential sources of pollution, to ensure that American Samoa Water Quality Standards are not violated, and determine whether ocean dumping of fish processing wastes is likely to unreasonably degrade or endanger human health or the marine environment. The site was adjusted in size in 1986 and location to ensure better mixing and protect shallow water habitats, while requiring the shortest feasible running time for the dump vessel and monitoring vessel.

Notice of Intent to Produce an Environmental Impact Statement on the designation of a dumpsite off American Samoa was published in the Federal Register (52 FR 4657, February 13, 1987).

I.C. AREAS OF CONTROVERSY

Insofar as can be determined, there is no controversy regarding the principle of ocean disposal of fish cannery wastes off American Samoa, but selection of the preferred site was made, based in large measure on comments received on the DEIS. The American Samoa Government strongly favors the ocean dumping alternative, responding to public and private opposition to terrestrial disposal (See section I.A.6).

I.D. ISSUES TO BE RESOLVED

The issues to be resolved are to determine: 1) whether the presently designated research dumpsite is the optimal site; 2) whether the deeper water site farther from shore should be designated; 3) whether the site should be enlarged for better mixing; and 4) what level of monitoring program is needed on an ongoing basis.

I.E. REGULATORY FRAMEWORK

Ocean dumping is regulated under one international treaty, several Federal laws and related regulations, and State/Territorial laws and regulations. Issuance of site designations and permits for ocean dumping of fish processing wastes are regulated by the requirements described in the following paragraphs. Applicability of and compliance with the various laws and regulations are summarized in Table 1.1.

I.E.1. INTERNATIONAL TREATY

The London Dumping Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (26 YST 2403: TIAS 8165) is the principal agreement governing ocean dumping internationally. This States, and became effective on August 30, 1975. Ocean dumping criteria

Table I-1. Relationship of Proposed Project to Relevant Federal and Territorial Statutes.

Statute	Responsible Agency	Compliance (X) under Alternatives				
		No Action Alternative	Terrestrial Alternative	Ocean Alternatives Preferred Site	Shallower Water	Deeper Water
Federal:						
Marine Protection, Research, and Sanctuaries Act	EPA DOC (NOAA)		NA	X	X	X
National Environmental Policy Act	EPA			X	X	X
Federal Water Pollution Control Act	EPA			X	X	X
Clean Air Act	EPA			X	X	X
Fish and Wildlife Coordination Act	DOC (NOAA, NMFS); DOI (FWS)			X	X	X
Marine Mammal Protection Act	DOC (NOAA, NMFS); DOI (FWS)		NA	X	X	X
Coastal Zone Management Act	DOC (NOAA) OCZM			X	X	NA
Endangered Species Act	DOI (FWS); DOC (NOAA, NMFS)			X	X	X
National Historic Preservation Act	Federal, Territory (State) Agencies			X	X	X
Territorial (State) American Samoa Government (ASG)						
Water Quality Standards	ASG			X	X	NA
Environmental Quality Commission	ASG			X	X	NA
Coastal Zone Management Program	ASG			X	X	NA

NA = not applicable

which are consistent with those of the London Dumping Convention have been incorporated into permits issued under the Marine Protection, Research and Sanctuaries Act (MPRSA), making the permits automatically in compliance with the London Dumping Convention.

I.E.2. U.S. FEDERAL LAWS AND REGULATIONS

I.E.2.a. The Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972, PL 92-532, as amended (33 U.S.C. 1401, et seq.).

Title I of MPRSA regulates the transport and disposal of materials in the oceans, originally prohibiting discharge of radioactive wastes and certain toxic materials. As amended by PL 93-254 (1974), dumping of any material is prohibited except under permit. MPRSA specifies criteria under which any materials may be discharged. The act also addresses the mandate for conducting research needed for protection of marine resources (Title 2).

Under Title 1, Sections 101(b) and 102(a), the EPA is empowered to issue ocean dumping permits for waste, other than dredged material, after consideration of the need, the effects on human health and welfare, the effects on living resources and ecosystems, the persistence of the material in the environment, effects on alternative uses of the ocean, and appropriate locations and land-based alternatives.

Several sections of the Act are relevant to the American Samoa canners. Section 101(a) provides that no wastes except those authorized by permit shall be transported from any location inside or outside the United States for the purpose of dumping in ocean waters, including the territorial sea or the zone contiguous to the territorial seaextending 12 n mi seaward.

Section 101(b) provides that, after December 31, 1981, the EPA Administrator may issue permits under Title 1 for dumping industrial waste into ocean waters if dumping is necessary to conduct research to determine whether dumping will have minimal adverse impacts on human health, welfare and amenities, on the marine environment ecosystems, or on economic potential.

Section 102(a) states that the Administrator may issue permits, except for dredged material, after notice and opportunity for public hearings, to transport wastes for the purpose of ocean dumping such that dumping will not degrade or endanger the items listed in Section 101.(b). A number of criteria for consideration are listed in the section, including health effects on humans and ecosystems, persistence or concentration of the wastes in the environment, and the existence of alternatives, all of the listed criteria are discussed in this DEIS.

Under Section 102(b), various categories of permits may be established.

Under Section 102(c), the Administrator may designate sites and/or times for dumping.

Section 102(d) stipulates that no permit is required under Title 1, for transportation or dumping of fish wastes, except when deposited in harbors or other protected waters, or where the Administrator finds that health, environment or ecological systems would be endangered at a specific location.

Section 104(a) specifies that the permits issued must include the type of material to be dumped, the amount, the location of dumping, the length of the permit with an expiration date and any special provisions. Section 104(b) provides for assessing fees for permits, and for reporting requirements.

Section 104(c) allows the Administrator to issue a general permit for dumping of a specific kind or class of materials, rather than site-specific permits, provided that the materials have been determined to have minimal adverse environmental impact.

Section 105 provides for civil penalties of not more than $50,000 for each violation of any provisions of Title 1, after notice and opportunity for a hearing and a schedule of actions is delineated.

Section 106(a) prohibits the issuance of permits or other authorizations for dumping by other agencies.

Section 106(c) requires that permits not interfere with navigation in the territorial sea.

Section 106(d) prohibits any State (including a Federal Territory or Commonwealth) from adopting or enforcing any rule or regulation related to ocean dumping. Any state may propose criteria to the Administrator to the extent that the dumping is permitted, and criteria may be accepted if they are not inconsistent with the purposes of the Act.

According to Section 106(e), this Title does not affect the Fish and Wildlife Coordination Act as amended.

Section 107 provides that the Administrator may delegate to or utilize other Federal or State agencies to carry out responsibilities under this Title. The responsibility for surveillance and enforcement, as well as safe transportation, is delegated to the Coast Guard.

Congress enacted a ban on ocean dumping (Ocean Dumping Ban Act of 1988, PL 100-688) as an amendment to MPRSA. Section 104B(k)(3)(B) specifically exempts tuna cannery wastes in American Samoa and Puerto Rico from the ban. Tuna wastes may be discharged under a permit issued by the EPA Regional Administrator.

Provisions of the MPRSA that are relevant to preparation of the EIS for ocean disposal of fish processing wastes are outlined in Table I.2.

I.E.2.b. National Environmental Policy Act of 1969 (PL 91-190) as amended, 42 U.S.C 4371, et seq.

The National Environmental Policy Act (NEPA) under Section 102(2)(C) requires consideration of the environmental consequences and alternatives of a Federal project before it can be implemented. This establishes requirements for preparation of an Environmental Impact Statement (EIS) for major projects with potentially significant environmental impact. In order for the Environmental Protection Agency to designate an ocean disposal site for processing wastes and issue a special permit to dump, the American Samoa canners must provide sufficient information to ensure that there is no significant adverse environmental impact and that there are no other feasible alternatives.

The President's Council on Environmental Quality, has issued regulations for implementing NEPA in 40 CFR Parts 1500-1508. Included are requirements for EPA to coordinate Draft Environmental Impact Statement (DEIS) documents with agencies that may have jurisdiction under the Fish and Wildlife Coordination Act (16 U.S.C. Section 661 et seq.), the National Historic Preservation Act (16 U.S.C. Section 470 et seq.), and the Endangered Species Act of 1973 (16 U.S.C. Section 1531 et seq.). NEPA regulations for the lead agency, EPA, are established under 40 CFR 6, which also specifies the content of Environmental Impact Statements.

I.E.2.c. The Federal Water Pollution Control Act (PL92-500, the Clean Water Act, Amendments of 1972, et seq.

The Federal Water Pollution Control Act (Clean Water Act) was developed in 1948 (PL 80-845) from the Rivers and Harbors Acts (The Refuse Acts) of 1890, 1894, and 1899. FWPCA amendments were added in 1956,

Table I.2. Provisions of the Marine Protection, Research and Sanctuaries Act (PL 92-532) Related to EIS Evaluation of Ocean Dumping of Fish Processing Wastes in American Samoa.

Title 40 CFR, Subchapter H - Ocean Dumping

- Part 220. Purpose, scope, categories of permit
- Part 221. Application for permit, adequate description of alternatives, nature of the waste
- Part 222. Action on permit applications under Section 102 of the Act
- Part 223. Contents of permits
- Part 224. Records and reports required of permittees
- Part 227. Ocean Disposal Constraints
    - 227.27. Limiting Permissible Concentration (LPC)
    - 227.28. Release Zone
    - 227.28. Initial Mixing
    - 227.29. Conclusions
- Part 228. Criteria for Site Selection
    - 228.5. General Criteria
        - 228.5(a). Disposal site position, relationship to fisheries, recreation, navigation
        - 228.5(b),(c),(d). Size of disposal site, nearness to shore
    - 228.6. Specific Criteria
        - 228.6(a)(1). Position, nearness of coast
        - 228.6(a)(2). Presence of living resources
        - 228.6(a)(3). Nearest amenities, including reefs
        - 228.6(a)(4). Waste constituents
        - 228.6(a)(5). Monitoring resources
        - 228.6(a)(6). Currents, thermocline
        - 228.6(a)(7). Other discharges in the area
        - 228.6(a)(8). Interference with other ocean uses
        - 228.6(a)(9). Existing water quality, ecology, evidence of cumulative effects
        - 228.6(a)(10). Attraction of nuisance species
        - 228.6(a)(11). Significant natural/cultural features, historical importance

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1961, 1965, and 1966, but the major revisions in 1972 (PL 92-500) gave the first adequate regulatory power to enforce control. Concurrent with the development of MPRSA the FWPCA was restricted to control of wastes entering the ocean through effluent outfalls, and MPRSA was delegated control of ocean dumping, including dredged materials. Thus the FWPCA and its subsequent amendments do not apply to the disposal of fish wastes by vessel dumping in American Samoa.

I.E.2.d. The Clean Air Act (42 U.S.C. 1451 et seq.)

The Act is intended to protect the nation's air quality by regulation of air pollutant emissions. It would be applicable to the present project if the shallow water site or the present dumpsite, which lie inside the three mile territorial sea limit, were to be used. The deeper water preferred site is outside the three mile limit. However, the waste transport vessel is loaded and transits Territorial waters, but emissions during these processes are negligible. This project does not involve air quality on the island.

I.E.2.e. Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661 et seq.)

The Fish and Wildlife Coordination Act requires that consideration of wildlife conservation be given by water resource development programs. The Act is not applicable to the ocean dumping permit, but MPRSA Act Section 106 (e) and NEPA require coordination with the Fish and Wildlife Service and this has been done. The permitted uses of the designated dumpsite will comply with this Act.

I.E.2.f. Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq.)

This Act, designed to protect all species of marine mammals, applies to actions of U.S. citizens as well as foreign nationals subject to U.S. jurisdiction. The Department of Commerce National Marine Fisheries Service is responsible for whales, porpoises, and pinnipeds other than walrus, while all other marine mammals are the responsibility of the Department of Interior Fish and Wildlife Service. Two species of whales breed and calf in waters around Western Samoa and American Samoa, and two species of dolphin are occasionally seen off Tutuila Island.

I.E.2.g. Coastal Zone Management Act of 1972 (PL 92-583, 16 U.S.C. 1456 et seq.)

The Act regulates development and use in the Coastal Zone, and assists States in developing Coastal Zone Management (CZM) Programs under a grant program administered by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce (DOC). Projects developed under Federal permits must be certified as consistent with approved State programs under Section 307(c) of the Act.

The American Samoa Government (ASG), as a Territory, has a Coastal Zone Management Program in effect. The center of the present dumpsite is within the three mile territorial limit, and the waste discharge plume would presumably lie, at least partially, within the territorial waters. **The preferred site is centered 5.45 n mi from shore, placing it well beyond territorial waters.** The ASG has consistently urged that an ocean dumpsite be used for cannery wastes and has participated in selection of the dumpsite. The DEIS **was** reviewed for consistency with their CZM Program (See Section V).

I.E.2.h. Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)

Under this Act, Federal actions are prohibited which jeopardize the continued existence of species designated as threatened or endangered. Section 7 of the Act requires that consultation be conducted with the U.S.

Fish and Wildlife Service and/or the National Marine Fisheries Service prior to implementation of the project. Both agencies responded favorably to the Notice of Intent to Prepare an EIS (Federal Register, 52 FR 4657, February 13, 1987 and the Honolulu offices of both agencies were contacted for input subsequently. Both agencies participated in selection of the preferred site (See Chapter V for comments).

I.E.2.i. National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.)

The Act is intended to preserve and protect historic and prehistoric resources. Federal agencies must identify cultural resources which might be impacted by a project, and to coordinate activities with the appropriate State representative. The depth of the present site, about 900 fms, and the steepness of the bottom slope preclude the presence of cultural resources. The preferred site is 1502 fms deep and farther from land. None of the sites have ever been habitable, nor do they contain historic or prehistoric resources.

I.E.3. U.S. FEDERAL EXECUTIVE ORDERS

I.E.3.a. Executive Order 11593, Protection and Enhancement of the Cultural Environment (36 FR 8921, May 15, 1971)

This Executive Order requires Federal agencies to institute measures necessary to insure that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored and maintained for the inspiration and benefit of the people. There are no such sites, structures or objects involved in this project.

I.E.3.b. Executive Order 12114, Environmental Effects Abroad of Federal Actions, January 4, 1979

This Executive Order requires Federal Agencies with authority to approve certain actions, to institute procedures for being informed of pertinent environmental considerations, and of taking them into consideration, along with national policy, in making decisions.

This Executive Order furthers the purposes of NEPA and MPRSA. It also applies to actions which have significant effects on the environment outside the geographic borders of the United States and Territories.

Procedures to be used include production of environmental impact statements such as this EIS.

I.E.3.c. Executive Order 12372, Intergovernmental Review of Major Federal Programs (47 FR 3059, July 16, 1982)

This Executive Order requires Federal agencies, to the extent permitted by law, to utilize the State process for determination of official views of State and local officials concerning a project, and to communicate with State and local officials as early in the program planning cycle as is reasonably feasible to explain plans of action. The present project was initiated at the request of the State (Territorial) officials, with strong support from local community leaders and the appropriate ASG officials have been consulted during preparation of the EIS.

I.E.4. AMERICAN SAMOA GOVERNMENT

I.E.4.a. Water Quality Standards, American Samoa Administrative Code (ASCA Section 24)

Water quality standards are established in the American Samoa Administrative Code, Chapter 02, Sections 24.0101 - 24.0208 (1973 et seq., updated in 1981; presently being revised). The standards of water quality, and the classification of the waters of the Territory according to their present and future beneficial uses, were prepared as required by the Federal Water Pollution Control Act of 1972 et seq., in accordance with the territorial Environmental Quality Act, 24.0101 - 24.1069 ASCA.

Under Section 24.0204(c), Water Classifications - Uses Protected, Prohibited, the following definitions were employed:

1) Open coastal waters are described as those which begin at the shoreline and extend seaward to the 100 fathom (600 ft, 183 m) depth contour from mean lower low water.

2) Nearshore open coastal waters are defined as those within 1000 ft of the shore, except if the water depth at that distance is less than 20 fms (120 ft) the nearshore waters extend to the 20 fm depth. All nearshore open coastal waters are to remain in, or as nearly in, their natural state as possible.

3) Oceanic waters are described in Section 24.0204(d), as those extending from the 100 fm (600 ft, 183 m) seaward. All oceanic waters are described as presently being close to their natural state. Among the prohibited uses are dumping of solid or industrial waste materials without an Environmental Protection Agency permit, except where allowed by exclusions in the Federal ocean dumping regulations.

Section 24.0206(a)-(g) provides standards of water quality for fresh water, embayments, Pago Pago harbor, nearshore open coast and oceanic waters (Rule 8-81, section 6).

I.E.4.b. Environmental Quality Commission (American Samoa Administrative Code, ASAC, Section 35.0105)

This section establishes the Environmental Quality Commission, consisting of five members to be appointed by the Governor. The Governor designated the Lieutenant Governor as Chairman, the Government Ecologist as Executive Secretary, and the other members as the Director of Public

Works, the Director of Economic Development and Planning, and the Director of Medical Services, or their representatives.

It is the policy of the Commission to promulgate regulations to implement enforcement and administration of Chapter 35.01, ASAC. Objectives are to achieve and maintain such levels of air and water quality as will protect human health and safety, prevent injury to plant and animal life and property, foster comfort and convenience to the people, promote the economic and social development of the territory and facilitate enjoyment of natural attractions.

Under Chapter II, the EQC prohibits construction or modification of sources, equipment or discharges for control of air or water pollution without a permit. Applications are forwarded by EQC to the Administrator, Environmental Protection Agency Region 9, to the Coast Guard representative, and to the Public Health Division of the Department of Medical Services in American Samoa. The EQC has not implemented a permit system provided in the code. Permit authority would be delegated to EQC by the EPA but no permit could be issued over the objection of the EPA Region 9 Administrator, or, in cases based on navigation/anchorage hazard, objections by the Corps of Engineers or Coast Guard. Since the FWPCA applies to end of pipe discharges and does not apply to ocean dumping, it does not apply to the present project.

I.E.4.c. Coastal Management Program, Territory of American Samoa, 1980

The Coastal Zone Management Act (CZMA, PL 92-583) which was passed in 1972 and amended in 1976 (PL 94-370), authorized Federal grants-in-aid to be administered by the Department of Commerce, under the National Oceanic and Atmospheric Administration Office of Coastal Zone Management. The American Samoa Coastal Management Program and Final Environmental

Impact Statement, prepared jointly with the CZM Office and the ASG, was published in 1980 as a result of the grants program. The ASG Development Planning Office was established for administering grants to implement the program, and it was designated the lead agency for implementing the planning process as well as Federal consistency requirements.

Under the American Samoa Coastal Management Plan (ASCMP) the Territorial Planning Commission has developed an Economic Development Plan (1979-1984) and Quality of Life Plan (1980) for the protection of the environment and natural resources. Chapter II C of the ASCMP presents objectives and plans for implementation of development of commercial and subsistence fisheries, protection of reefs, marine water quality, marine mammals and the Green Sea and Hawksbill Turtles. At either the present dumpsite or the shallower water site, activity would take place within the three mile limit of territorial waters, and the ASCMP applies. The deeper water preferred site is outside the territorial limits.

CHAPTER II. ALTERNATIVES

II.A. DESCRIPTION OF ALTERNATIVES

II.A.1. NO ACTION ALTERNATIVE

The no action alternative consists of not issuing an ocean dumping permit. If no action were to be taken on issuing an ocean dumping permit in American Samoa, the canneries would have several alternatives:

1) to ocean dump without a permit, which would make them liable for civil and criminal penalties;
2) to dump on land in violation of court orders, ASG, and Federal regulations;
3) to stop using the DAF equipment which creates the sludge. If DAF equipment were bypassed, the highly organic wastes would remain as liquids and be discharged into the harbor. This would create anoxic and septic conditions, violating ASG and Federal water quality regulations and NPEDS permit conditions; or,
4) to discontinue operation of canneries in American Samoa.

II.A.2. TERRESTRIAL ALTERNATIVE

Dumping of sludge on land was begun in American Samoa following the installation of DAF equipment in 1974 - 1975. Prior to that installation, liquid wastes were screened for solids to use in fish meal and the liquid discharged into the harbor. Now that production quantities have increased greatly, this would be even less acceptable environmentally and esthetically than it was when pressure was exerted to install the then-experimental DAF system in the early 1970s.

Land dumping took place in two locations between 1975 and 1980. A pit was used by Van Camp (now Samoa Packing) near Tafunafou on Tafuna

Plains, and Star-Kist dumped at a diked ravine near Futiga. There were so many valid environmental and health related protests that staff of the EPA National Enforcement Investigations Center (NIEC) from Denver recommended that EPA reconsider their blanket prohibition of ocean dumping. Although it might be physically possible at present to restore the same landfill sites, there would be intense resistance to such a move by ASG (See Section I.A.6, and Chapter V and Appendix D for ASG correspondence on eliminating land disposal).

II.A.3. OCEAN DISPOSAL ALTERNATIVES

Three potential ocean disposal sites have been identified herein:

1) The present site is located at **14°22'11" South latitude (equals 14°22.18" S), and 170°40'52" West longitude (equals 170°40.87' West on NOAA Chart 83484) in 910 fms (1664 m, 5460 ft) of water. It is about 4.7 n mi (8.7 km) south of Breakers Point and about 2.25 n mi (4.16 km)** from the fringing reef off of the airport runway.

2) A shallower water site at the 120 fm contour (200m, 720 ft), about 2.3 n mi from Breakers Point and seaward of Taema Bank at 14°20.00' South by 170°39.30' West.

3) A deeper water site 3.0 n mi in diameter **in 1502 fms (2746 m, 9012 ft) at 14°24.00' South by 170°38.30' West about 8.1 n mi (14.98 km) south southeast of Breakers point, 5.16 n mi (9.55 km) from the airport fringing reef, and 5.45 n mi (10.08 km) from shore. It is centered 2.27 n mi beyond territorial waters, with the periphery 0.8 n mi beyond them.**

The present site is adequate for existing conditions and quantities of waste. The total volume of wastes may be increased in the future above the amounts of DAF sludge presently discharged by the addition of liquid wastes (press water and precooker water) now discharged to the harbor.

The deeper water site was selected by EPA Region 9 after consideration of agency and public comments on the alternatives presented in the DEIS, to provide further assurance that wastes would not impinge on reef and shore habitats. The dump vessel should observe the direction of surface flow at the center of the site, proceed 1.2 n mi upcurrent before beginning to dump and center their disposal pattern at that point.

II.A.4. OTHER APPROPRIATE ALTERNATIVES

A number of processes and types of equipment have been proposed and tested by the tuna processors at various locations in California, Puerto Rico and American Samoa in attempts to solve the problems of sludge disposal created by DAF treatment of liquid wastes. Since the sludge and other materials to be dumped are essentially the same in Puerto Rico, California and Samoa, the information is applicable to the present EIS discussions. A number of these proposed alternative processes, with their advantages and disadvantages, are addressed in the following paragraphs.

II.A.4.a. Centrifuge, Belt Presses, Vacuum Filter Presses

These devices thicken and dewater sludge, thereby reducing volume and concentrating solids. Tuna canners in California and Puerto Rico have operated centrifuges or belt presses for several years, with varying degrees of success in the removal efficiency and concentration of feed solids. With oily wastes, the process results in unacceptable recycling of noncaptured solids and oil and grease back into the treatment plant, thereby causing a poorer effluent quality and NPDES permit violations. Thickening of the DAF sludge would not preclude the need for ocean disposal.

II.A.4.b. Anaerobic Treatment of Waste Water and Anaerobic Digestion of Sludge

Anaerobic processes are well understood, and sanitary sludge has been digested at municipal treatment plants for many decades (e.g., Mara, 1976). In addition, many proprietary equipment and process systems have been developed to treat industrial wastes anaerobically. The advantages of anaerobic systems are their simplicity; low energy requirements, reduction in suspended solids, stabilization of the sludge and production of methane gas, which can be used as a fuel to generate power or to heat the process. The canners have been contacted by several companies having such processes, and have sent samples to them for testing.

A small-scale pilot study was funded by the ASG and the U.S. Department of Energy to test the anaerobic biodegradability of the Samoa tuna canners' sludge (Action Resources, Inc., 1980). The investigator concluded that tuna sludge is anaerobically degradable and can generate a gas containing 60 to 65% methane which could be used as a fuel. He urged that the canners construct suitable equipment to digest their sludge anaerobically. However, the investigator did not have full scale operating experience with anaerobic digestion and overlooked some of the major problems with such a system. These problems are as follows:

1) The same volume of sludge fed into the digester must be removed and provisions made for disposal of the residual waste.
2) Anaerobic systems are prone to biological upset due to widely variable loading rates. A backup system or a duplicate digester must be available in case one is not functional.
3) Anaerobic systems are very expensive to construct. The hydraulic residence time required is 30 to 40 days, so that

the canners would need a tank of approximately 1.7 million gallons for sludge alone, plus ancillary pumps, piping, gas mixing equipment, compressors and gas storage tankage to make the system viable. The capital cost to build such a system would be $3,000,000 to $4,000,000.

4) Digested sludge is highly odoriferous and also contains large amounts of hydrogen sulfide, which is potentially hazardous to operators. It has a lower suspended solids content than the undigested sludge and may be difficult to dewater. The odor level from the treatment plant would be greatly increased and the canners would still have a disposal problem with the sludge.

On the positive side, the canners would gain the use of the gas from the process, although it be only enough to operate the process. The canners would still need to have an alternative disposal option for the sludge should the digester become upset. Typically, upset digesters require up to two or three months before they can be fully loaded again.

II.A.4.c. <u>Animal Feed Production</u>

Star-Kist investigated the feasibility of producing an animal feed product utilizing sludge in 1979. The product was manufactured, animals were fed the test product, and taste testing of the meat was completed. The feed manufacturing process requires the use of a carrier grain material, such as alfalfa, since the sludge has high oil and grease and water content which cannot be readily dried alone. The final product was shown to have a lower protein content than other competing feeds such as fishmeal or soybean meal, and also had a disagreeable color and odor compared to other feed products. Therefore, even on the basis of its feed value, the acceptability and value of the product would be much reduced from the more accepted feed products.

Taste testing of the meat determined that the maximum percentage of this product that could be fed to an animal is 2%, since above that portion the meat becomes off-flavored. Star-Kist concluded that, although a product could be manufactured, its marketability would be poor. The limited market for such a product in Samoa would also mean that, unless the product was disposed of as a waste, the product would have to be shipped out for marketing. This opens up problems of acceptability to the Food and Drug Administration and other regulatory agencies governing inter-state shipment of animal feed products. In the canner's view, the manufacturing of such a product is not practical.

II.A.4.d. Oil Recovery

Some tuna canners have extracted fish oil from press water and precooker water. This results in some reduction in the DAF sludge volume while recovering a useful product. However, given the remoteness of American Samoa and the high shipping cost to an end user, oil recovery has not been practical in Samoa. Oil recovery would not significantly reduce the waste disposal problems for the Samoa canners.

II.A.4.e. Incineration

Some of the Puerto Rico canners have received proposals to investigate incineration of DAF sludge. The proponent believes that incineration is technically a feasible option, although it would not be as reliable compared to other available options. The high water content of the sludge would mean that supplemental fuel would be required. The process would also give off objectionable odors and generate smoke during upsets in the combustible process. In addition, previous experience with incineration is that these systems require high maintenance and are not always reliable, even though they seem simple. The residue would still require land or ocean disposal.

II.A.4.f. Pulse Jet Drying

Star-Kist Foods sent sludge to Sonodyne's test facility located in Newburg, Oregon in 1980. The Sonodyne dryer uses a pulse jet principal which uses heat and acoustics to dewater the waste, producing a fine grain material. The process seemed to be effective during the short test but it was noted that there were severe odors and smoking problems. There have also been reliability problems with Sonodyne's equipment and very high noise levels, which would make the process environmentally unacceptable in populated areas. Furthermore, the waste would have to be landfilled since it would probably not be acceptable as an animal feed product. Very high fuel cost needed to dry the material completely would make this alternative prohibitive, and it is less attractive than incineration, which at least uses the heat value of the waste solids and oil to reduce supplemental fuel requirements.

II.A.4.g. Ultrafiltration

Ultrafiltration is a dewatering process similar to reverse osmosis, differing only in the pore size of the membrane. Although ultrafiltration has not been tested on cannery sludge, Star-Kist did apply it to some high strength waste waters at a Star-Kist California facility.

Tests showed that ultra- (hyper) filtration could be used as a first stage in evaporating high strength waste waters to produce a solubles product, as has been done by the fish industry in the past. However, it is not likely to be effective in dewatering the already thick sludge, nor would it be practical, given the large amounts of filtration membrane area required for the large volumes of waste generated. Production of solubles in Samoa would also not be economically viable, nor would it eliminate the need for sludge disposal.

II.A.4.h. Composting

Some of the Puerto Rico canners were contacted by a corporation regarding co-composting of wastes such as fish cannery sludge with municipal refuse, to produce a material that would be used in agriculture. The sludge would need a carbonaceous bulking agent, such as the refuse, in order to make the system viable. It is not an acceptable option in American Samoa, since there would not be an adequate supply of municipal refuse.

II.B. DISCUSSION OF ALTERNATIVES

II.B.1. ALTERNATIVES NOT CONSIDERED FOR FURTHER ANALYSIS

II.B.1.a. No Action Alternative

Several no action options were noted in Section II.A.2, each of which would have severe negative consequences. The no-action alternatives include: 1) ocean dumping without a permit; 2) landfill without a permit or site; and 3) removing DAF equipment while discharging all wastes as liquids into the harbor. This was a severe environmental problem before the development of DAF treatment and installation in the 1970s. Since then production has increased as both plants were enlarged. It would be an environmental disaster to release all wastes into the harbor.

Under any of the no action options, the canners would be in violation of laws and regulations of the ASG and the Federal Government, and would be liable to civil and/or criminal penalties. The canners would probably be forced to close their American Samoa operations. With the increased activity in the western Pacific tuna fishery, the canners would probably move out of U. S. territory, depriving American Samoa of its only industry. The fish processors produce more than 98% of the exports from American Samoa (ASG, 1981). They are the only large private employer, with about 4,000 employees, although they are second in numbers of employees to the American Samoa Government, which is in turn subsidized heavily by the U.S. Government (ASG, 1981; Iverson, 1987; Schug and Galea'i, 1987). Payroll from the canneries in turn supports many of the small businesses and services (Section III D).

II.B.1.b. Terrestrial Alternatives

Although the ASG strongly objects to any landfill on Tutuila Island, the only sites that could reasonably be considered now are those that were used from 1975 to 1980. Other areas were investigated by the canners and ASG without success, in part because of the system of communally held family lands that is so pervasive in American Samoa (USACOE, 1979).

The initial dumpsite, used by Van Camp (now Samoa Packing) was about 0.75 mi from the west end of the airport runway in the bush near Tafunafou on Tafuna Plain. Van Camp built a road into the area, after which landowners began to build housing along the road. This then was followed by complaints from the new residents of odors, flies, rats and traffic, and finally by the fatalities mentioned earlier. There was no available solid trash to absorb moisture in the ponded sludge, and the site would have quickly become too small to contain the mixture if it had been.

Star-Kist's dumpsite was at Futiga, north of Larsen Bay. A ravine was diked off by an earthen dam, which eventually became saturated from the ponded semisolid wastes and the very high annual rainfall, and the dam collapsed during torrential rains. The accumulated decaying wastes flowed down the ravine to Fagalua (Cove) into Larsen Bay, where it was finally dissipated by wave and tidal action (landfill information, pers. comm., Vincent Evich, formerly with Star-Kist Foods).

Larson Bay supported a lush coral growth prior to invasion by the Crown of Thorns starfish in late 1978, which decimated the coral growth. The bay still supported large numbers of adult fishes when surveyed (USCOE, 1980). Fagalua cove is scoured by riptides so wastes dissipated well, and there apparently was no evidence of long term environmental damage from the spilled sludge. Fortunately a ridge separates the ravine from Fagatele Bay, then being considered for designation as a National Marine Sanctuary as an area not impacted by urban activities.

A small pilot project of spreading sludge on farmland was tested by

Star-Kist in the 1970s and abandoned because of runoff, odors and flies.

The cumulative effect of these attempts to carry out land dumping have illustrated well the fact that land dumping on island territories is not a feasible alternative to management of fish processing wastes.

II.B.1.c. Shallower Water Site

The shallower water site lies about 2.3 n mi (4.26 km; 15,798 ft) seaward of Breakers Point and the entrance to Pago Pago Harbor at the 120 fm contour (14°20'00" South by 170°39'30" West). While this area is a shorter distance to travel for the dump vessels, it is not seriously considered as an option because of its proximity to Taema Bank. That area is rich in invertebrates and reef associated fish. Drogue studies have indicated that wastes dumped there would probably reach the reefs on the west side of the harbor approach and the airport fill, and might enter the harbor. Also, dumping in the area could be hazardous to the dump vessel and to other marine traffic. The many negative factors determine that this alternative will not be considered further.

II.B.2. OCEAN DISPOSAL ALTERNATIVE

Ocean disposal has been practiced in American Samoa since an interim permit was issued in 1980. No ill effects **on the dumpsite** have been observed during this period. Two ocean alternatives, the present site and the deeper **water** site, **were** considered by EPA **in the DEIS. The deeper water site was** selected as the preferred site after consideration of responses to the DEIS by agencies, the public and the industry.

II.B.2.a. Present Site Alternative

The present site alternative, under current levels of dumping, is the ocean disposal site located in 1987 at 170°40'52" West longitude (equals 170°40.87' West on NOAA Chart 83484) and 14°22'11" South latitude (equals $14^{o}22.18'$ South on NOAA Chart 83484) (See Figure II.1.). The site is located approximately 2.25 n mi from the nearest fringing reef in water approximately 910 fms (1664 m, 5,460 ft) in depth. The previous EPA dumpsite, operated from 1980 to 1986 under Special Permit no. OD 79-01/02, was centered approximately 0.4 n mi northwest at $170^{o}41'00''$ W and $14^{o}22'00''$ S in approximately 800 fms (1463 m, 4800 ft) depth.

The principal reason for changing the 1980 site to the present 1987-1988 location, (see Section II.A.4), was to enlarge the dumpsite diameter to 1.5 n mi by moving the center about 0.4 n mi seaward of the nearest coast to offer better protection of the reefs. This did not appreciably alter the transit time, but placed the site in water about 100 fms (183 m, 600 ft) deeper, and also made visual navigation easier. Although the new position is more difficult to plot on navigation chart NOAA 83484, which is calibrated in tenths of minutes instead of seconds, it is easier for vessels to locate because it is on a direct line of sight due magnetic north to the Breakers Point light on Tutuila Island. Navigation has been limited to sextant and visual reckoning in the islands, which lack Loran C, but Radar has been installed to improve positioning of the dump vessel, as well as for any monitoring vessel. Radar is, however, not sufficiently accurate to improve positioning of the monitoring vessel on stations that are very close together.

Visual navigation is difficult at times in local waters because the weather is so changeable. Sudden tropical squalls or major front storms frequently obscure shoreline markers completely for minutes to hours at a time. As reported in a National Marine Fisheries Service unpublished document, the oceanographic ship Townsend Cromwell attempted to survey fishing banks east of Tutuila Island. They stated that navigation was

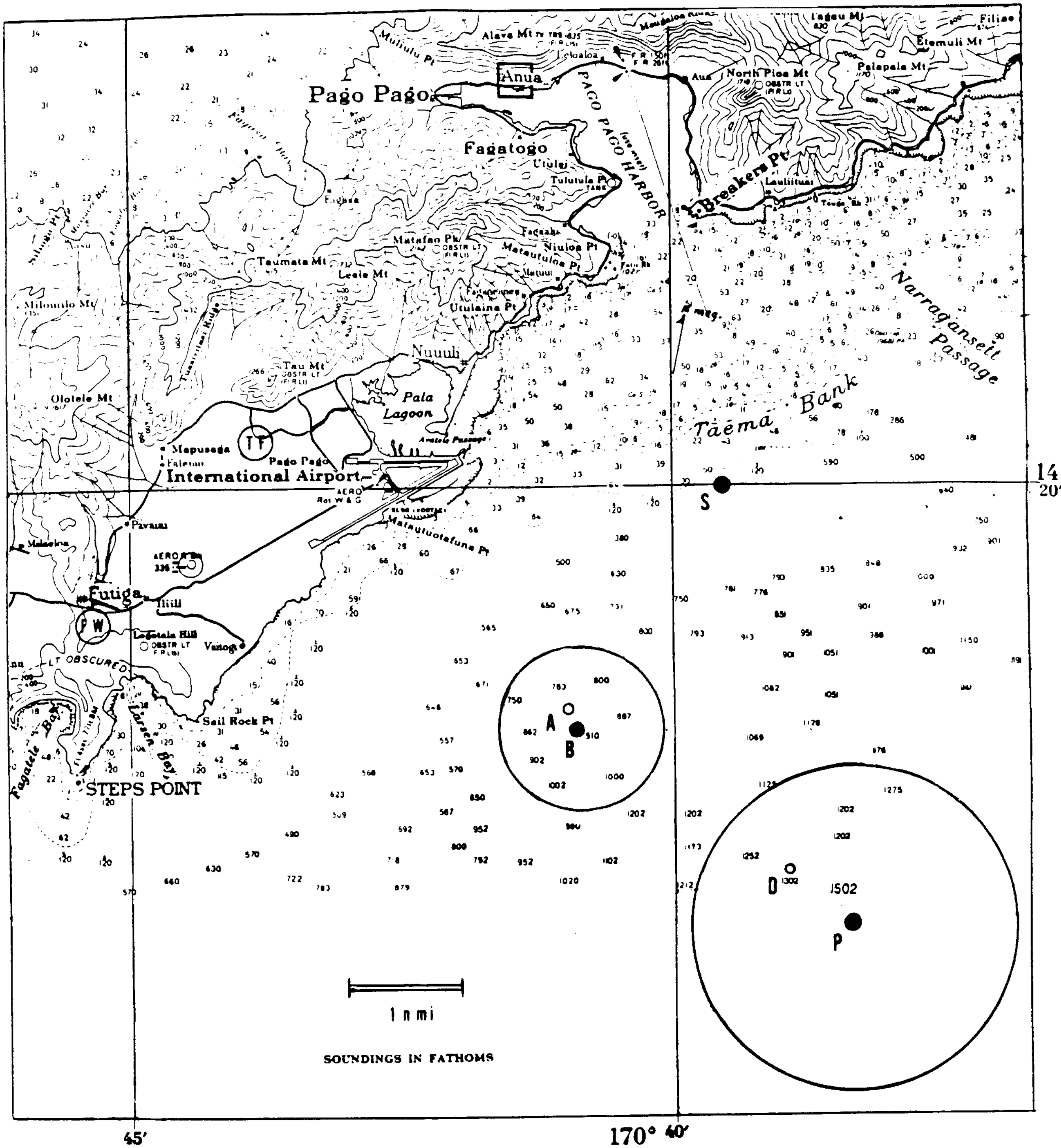

Figure II.1. Location of past, present and preferred cannery waste dumpsites.

A - Cannery waste dumpsite center, 1980-1985
B - Cannery waste dumpsite 1986- ; diameter of circle is 1.5 n mi
D - Deeper water alternative site
P - Preferred deeper water site; diameter of circle is 3 n mi
S - Shallow water alternative site
FW - Futiga land waste pit
TF - Tafunafou land waste pit
Box - Anua, location of canneries

major problem throughout the study. Although the ship was equipped with Loran, Omega and Satellite navigational systems, Loran signals are not available in waters around American Samoa, and Omega did not provide accurate navigational fixes. While Satellite fixes are accurate, they were available only about once every 70 min. Winds and currents often set that large oceanographic vessel off its estimated position by as much as 2.5 n mi during the 70 minute interval. A Global Positioning System (GPS) failed to function on that cruise.

The change of the dumpsite by about 0.4 n mi seaward of the 1980 site did not appreciably alter the trajectory of the waste plume since it is sufficiently seaward to remain offshore from the reefs. No physical evidence has been collected with documentation of place and time that the wastes have come ashore, but some local residents have stated that they have smelled the plume from shore or observed it on the reefs (See Section V.D). A fish kill that was reported at Nu'uuli village was first attributed to the ocean dumping. Further investigation found that students from a rival high school had dumped a barrel of powdered chlorine on the reef, killing virtually everything. Employees at the airport and others have claimed to have observed the vessel dumping too close to shore, but this could not be documented. The lack of navigation equipment and of a marker at the site made the possibility of error greater, both for the vessel and the residents observing it.

The change in water depth from approximately 800 to 910 fms (1464 m to 1665 m) would have negligible effect on the fate of the waste, since none of it is expected to reach bottom. The bottom composition is unknown, but is probably of andesite and basaltic volcanic rock with pockets of eroded calcareous sand and gravel, based on the geology of the island (ASG, 1981b). Living coral reefs are found in shallow waters, while older drowned coral reef limestones occur in some areas along the shore and at Taema and Nafanua Banks. Live stony corals (scleractinean) would not be found in the deeper waters of the present or the preferred deep water site, although soft (non-scleractinean) corals might inhibit the site if areas of hard substrate and sufficient currents are present (R. Wass, FWS, pers. comm.).

II.B.2.b <u>Deeper Water Site: The Preferred Site</u>

At the present time the processors are dumping 24,000 gal, the limits of the dump vessel capacity, at the designated dumpsite twice a day, a total of 48,000 gal/day. The canners may increase the disposal capacity in the future, however. In emergency circumstances such as vessel downtime or delays due to rough seas more daily trips might be made without exceeding total permitted disposal volume. Their present research permit allows a total of 256,900 gal per day, of which 91,400 gals is sludge. While the quantity of sludge is not expected to increase significantly from 24,000 gals per trip in the future, liquid wastes presently permitted but not being dumped may be added, which would increase the total volume dumped but would dilute the sludge. To prevent the possibility of a surface slick approaching the shore, the dumpsite should be moved farther from shore outside territorial waters and the dumpsite enlarged to 3.0 n mi to provide a larger mixing zone.

II.B.3. SUMMARY OF ADVANTAGES AND DISADVANTAGES

II.B.3.a. <u>Present Site</u>

The present site was selected for waste disposal after consideration of a number of factors. The advantages of that site are as follows:

1) Provides adequate distance from the shore to prevent fouling

of fringing reef under present loadings.

2) Water is sufficiently deep to preclude deposition of solids.

3) Located at the shortest transport distance for dumping compatible with protection of reefs and banks.

4) Close enough to shore to allow fixing of monitoring positions by visual sighting on shore markers.

5) Would increase useful nutrients in a nutrient-poor nearshore environment.

Disadvantages of the present site are as follows:

1) The present dumpsite, and generally the plume, lie within the ASG territorial waters, making the ASG Water Quality Standards applicable. Standards are presently being revised but cannery wastes on occasion exceed phosphorus and nitrogen standards. Dissolved oxygen levels have not been a problem (See Appendix A.).

2) In the event of a significant escalation in quantities to be dumped, beyond those presently being dumped, the plume would at times encroach on fringing reefs.

II.B.3.b. Deeper Water Site: The Preferred Site

Advantages of the deeper water site are as follows:

1) There is minimal possibility that the plume would encroach on environmentally sensitive areas.

2) The site would be about 5.45 n mi from the nearest shore, well outside the 3 mi limit of ASG territorial waters.

3) A larger zone of dilution 3.0 n mi in diameter could be obtained.

4) Larger quantities of waste could safely be dumped.

Disadvantages of the deeper water site are:

1) Longer distance to travel for dumping.

2) Visual navigation would be more difficult for monitoring.

3) Monitoring conditions (i.e., rougher water, longer transit time) would increase difficulty and decrease accuracy.

4) Much deeper water and distance from shallow water might preclude enrichment of benthos.

III.B.4. COMPLIANCE OF THE ALTERNATIVES WITH GENERAL CRITERIA FOR SELECTION OF SITES (40 CFR 228.5)

II.B.4.a. General Criteria, 40 CFR 228.5(a)

> The dumping materials into the ocean will be permitted only at sites or in areas selected to minimize the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries and shell fisheries, and regions of commercial or recreational navigation.

Disposal at the present dumpsite area since 1980 has not interfered with commercial fishing, sport fishing or recreational activities. The present site and the preferred deeper water site are both out of the traffic patterns for transportation to Pago Pago Harbor, although there are no designated corridors in the area. Traffic is not heavy, and visibility is generally good.

II.B.4.b. General Criteria, 40 CFR 228.5(b)

> Location and boundaries of the disposal sites will be so chosen that temporary perturbations in water quality or other environmental conditions during initial mixing caused by disposal operations anywhere within the site can be expected to be reduced to normal ambient seawater levels or to undetectable concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shell fishery.

The center of the present site is about 2.55 n mi (4.7 km) from the nearest shoreline, and the center of the deeper water preferred site is about 5.45 n mi (10.08 km) from that shoreline. The shoreline is composed of coral rubble fill for the airport runway with a rich coral community on the seaward margin of the fill. Pala Lagoon, inshore of the airport, is an ASG area of special biological significance. There is a National Marine Sanctuary is at Fagatele Bay, about 4.75 n mi west of the present site and about 7.0 n mi west of the deeper water site. Wastes are below the limits of detection well before the dumpsite waters could reach shore. The longshore current, which generally flows southwest between the 120 fm and the 600 fm contours generally, keeps the cannery waste plume offshore even when the prevailing current at the dumpsite is toward the northwest. If a slick remains visible on calm days, it will usually turn seaward south of the region of Steps Point. It is possible that complaints of slicks approaching shore are occurring if the longshore current reverses in the absence of trade winds but this was not observed in 1982-83 when trade winds were absent. During rough seas the slick breaks up almost immediately. The plume has not reached the shellfish gleaning areas around outer Pago Pago Harbor. There is no commercial shellfishery in the area, and no geographically limited commercial or recreational fisheries. The slick from the deeper water site would not be expected to reach the longshore current (See Appendix B). However, it is emphasized that water quality parameters are usually at ambient levels even when a sheen is visible beyond the boundary of the site.

II.B.4.c. <u>General Criteria 40 CFR 228.5(c).</u>

> If at any time during or after disposal site evaluation studies, it is determined that the existing disposal sites presently approved on an interim basis for ocean dumping do not meet the criteria for site selection set forth in Sections 228.5 and 228.6, the use of such sites will be terminated as soon as suitable alternative disposal sites can be designated.

The present site is an interim site which has been operated in the area since 1980, with a minor adjustment to location of the center and enlarging of the diameter from 1 n mi (1.85 km) to 1.5 n mi (2.8 km). There has been no evidence of deleterious effects other than transitory esthetic effects on the environment from ocean dumping at that site. The deeper water site, with a larger diameter of 3.0 n mi (5.55 km), is farther from shore and would also not have any deleterious effects on the environment.

II.B.4.d. General Criteria 40 CFR 228.5(d)

> The sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit implementation of effective monitoring and surveillance programs to prevent adverse long-range impacts. The size, configuration, and location of any disposal site will be determined as a part of the disposal site evaluation study.

The present site is limited to a 1.5 n mi diameter and cannot be enlarged significantly without reducing the distance which keeps the plume from encroaching on shallow water habitats. The deeper water preferred site can be enlarged to a 3.0 n mi diameter without encroaching on territorial waters and shallow water habitats, and thus can accommodate larger quantities of waste. The possibility of dumping larger quantities of more dilute wastes in the future favors designating the larger deeper water site and placing the location of the dump vessel near the upcurrent periphery during disposal.

II.B.4.e. General Criteria 40 CFR 228.5(e)

> EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf and other such sites that have been used historically.

Both the present site and the deeper water preferred site are well beyond the (island continental) shelf, the 100 fm contour. The present site is in about 910 fms (1994 m) of water, and the deeper water site is in 1502 fms (2736 m). The present site meets the criterion for disposal at a site that has been used in the past, whereas the deeper water site does not. In both cases, the wastes are suspended primarily in the upper 20 m of water until they are dispersed or metabolized by marine bacteria (Chapter III B), and no accumulation of sediment occurs.

II.B.4.f. Comparison of the Disposal Sites to EPA's 11 Specific Criteria for Site Selection 40 CFR 228.6(a)

Detailed discussions of the sites in relation to the 11 specific criteria are presented in Chapter III, Affected Environment, and in Chapter IV, Environmental Consequences.

II.B.5. SELECTION OF THE PREFERRED ALTERNATIVE

Both sites comply with specific criteria to serve adequately as the preferred site under existing conditions. **The deeper water site has been selected as the preferred site** by EPA Region 9, in part on the basis of comments on the DEIS received from regulatory agencies, the tuna industry and the public. **It allows for possible increase in quantities of liquid waste dumped and protects territorial waters, including reef habitats.**

The introduction of dissolved air flotation (DAF) sludge into oceanic waters will have a temporary effect on the turbidity, levels of suspended solids, oil and grease, phosphorus, nitrogen, and biological oxygen demand (BOD) in the upper 20 m of the receiving waters. Initial mixing by pumping and turbulence in the wake of the vessel will be augmented by diffusion and dispersion due to wind and waves, and currents. There are minor specific problems at each site, which are reviewed in the following paragraphs. Table II.1. summarizes compliance with the specific criteria.

II.B.5.a. Present Site

Dumping has been underway in the area of the present site since 1980, but no accumulation of materials has occurred in that area, since the wastes do not reach the benthos. The plume is largely a phenomenon of the upper 20 m of water, moving mostly as wind driven circulation above the thermocline, which lies between 100 and 200 m in tropical oceanic waters in the region. The wastes are diluted, dispersed and biodegraded in the upper 20 m of the water column.

One drawback of the present site is that it cannot be expanded appreciably without the plume being carried toward shallow water habitats if larger quantities of waste are dumped. This would occur if press water and precooker water, now being discharged to the harbor after DAF treatment, were to be added to the DAF sludge for ocean dumping without treatment, diverting those high strength liquid wastes from the harbor. Such a plan is under consideration at present by the canners and EPA. No significant expansion of plant capacities or sludge quantities to be dumped is planned. The present permit allows for disposal of much larger amounts than are being produced (See Section III.A) to accommodate emergency situations which might arise if a backlog of waste were accumulated due to storm conditions, or plant or vessel malfunction.

Standards for American Samoa oceanic waters are shown in Table II.2. Wastes sometimes exceed ASG values for phosphorus and nitrogen (See Appendix A) for summaries of field data).

II.B.5.b. <u>Deeper Water Site: The Preferred Site</u>

The deeper water site can accommodate a larger diameter without approaching shallower water habitats. This would provide for the contingencies mentioned above with regard to the present site without having to select a different site in future years.

One difficulty with the deeper water preferred site would be in conducting a field monitoring program with sampling from a small boat,

Table II.1. Summary of Compliance with Specific Criteria of the (40 CFR (228.6)(a) Present Site and the Deeper Water **Preferred** Site.

	Specific Criteria (228.6)(a)	Present Site	Deeper Water Site
(1).	Position	$14^{o}22.18'$ S x $170^{o}40.87'$ W	$14^{o}21.00'$ S x $170^{o}38.30'$ W
	Distance from shore	2.55 n mi (4.70 km)	5.45 n mi (10.08 km)
	Depth of water	910 fms (1664 m)	1502 fms (2746 m)
(2).	Presence of living resources	pelagic, neritic species	pelagic, neritic species
(3).	Nearest amenities, including reefs	2.25 n mi (4.16 km)	5.16 n mi (9.55 km)
(4).	Waste constituents	DAF sludge, press water, precooker water	same, plus possible future press water, precooker water
(5).	Monitoring resources	limited	limited
(6).	Currents	0.16 - 0.67 k (8.2 - 34.4 cm/sec)	similar * similar *
	Thermocline	100 - 200 m *	100 - 200 m *
(7).	Other discharges in the area	no ocean dumping; Tafuna S.T.P. outfall ± 2.0 n mi	no ocean dumping
(8).	Interference with other ocean uses	none	none
(9).	Existing water quality	excellent	excellent
	Evidence of accumulation	none	--
(10).	Attraction of nuisance species	none	--
(11).	Significant natural/ cultural/historical features	none	none

* no field data available; based on available literature

Table II-2. Standards for American Samoa Oceanic Water.

Parameter	Median not to exceed given value	Not to exceed given value 10% of the time	Not to exceed given value 2% of the time
Turbidity (NTU)	0.20	0.29	0.36
Total Phosphorus (ug P/L	11.00	23.00	35.00
Total Nitrogen (ug N/L)	115.00	180.00	230.00
Chlorophyll a (ug/L)	0.18	0.40	0.65
Light Penetration Depth (feet)	150*	132*	120*
Dissolved Oxygen	Not less than 80% of saturation or less than 5.5 mg/L. If the natural level of dissolved oxygen is less than 5.5 mg/L, then the natural level shall become the standard.		
pH	The range shall be 6.5 to 8.6 pH units and within 0.2 pH units of that which would occur naturally.		

* To exceed the given value 50%, 90% and 98% of the time respectively.

such as has been conducted during the research permits. The area may have higher seas, probably stronger winds and is farther from shore, which might make it more difficult for the monitoring vessel and crew. Since the data base for ocean dumping off American Samoa is large, it may be feasible to monitor the composition of the wastes and take field samples from the dump vessel, recording current direction before and after dumping and obtaining limited samples after dumping is completed. The travel time for the dump vessel is longer, making it more difficult for the canners to run two trips a day.

CHAPTER III. AFFECTED ENVIRONMENT

III.A. OCEAN DISPOSAL SITE CHARACTERISTICS

III.A.1. SITE LOCATIONS

The sites considered for ocean dumping lie south of Tutuila Island, the largest of the islands of American Samoa, located about 2600 mi (4160 km) south southwest of the Hawaiian Islands. The sites were reviewed in some detail in Chapter II, Alternatives. A brief description of each site is presented below, and shown in Figure III.1.

An interim dumpsite, located at 171°41'00" W by 14°22'00" S in 800 fms (1463 m; 4800 ft), was used by the canners from 1980 to 1986. In 1987, the site was enlarged from a 1.0 n mi (1.85 km) diameter to a 1.5 n mi (2.8 km) diameter and the center was moved about 0.25 n mi (0.46 km) to its present location to accommodate the increase in diameter and maintain the same distance from shore. DAF sludge has been dumped in this area since 1980 under EPA permitted operations.

III.A.1.a. Present Site

The present site is the one described in the Federal Register (vol. 52 FR 4657 February 13, 1987), as a 1.5 n mi (2.8 km) diameter circle, the center of which is located at 14°22'11" South by 170°40'52" West. (This is at 14°22.18' S x 170°40.87' W on NOAA Chart 83434). The center is about 2.25 n mi (9100 ft; 4.16 km) from the nearest fringing reef. Depth of the site is approximately 910 fms (1664 m; 5460 ft) in an area sloping steeply toward the south and southeast.

III.A.1.a. Deeper Water Preferred Site

The center of the deeper water site has been relocated at 14°24.00' South and 170°38.30' West at a depth of 1502 fms (2746 m; 9012 ft). The site is 8.1 n mi (14.98 km) south southeast of Breakers Point. The

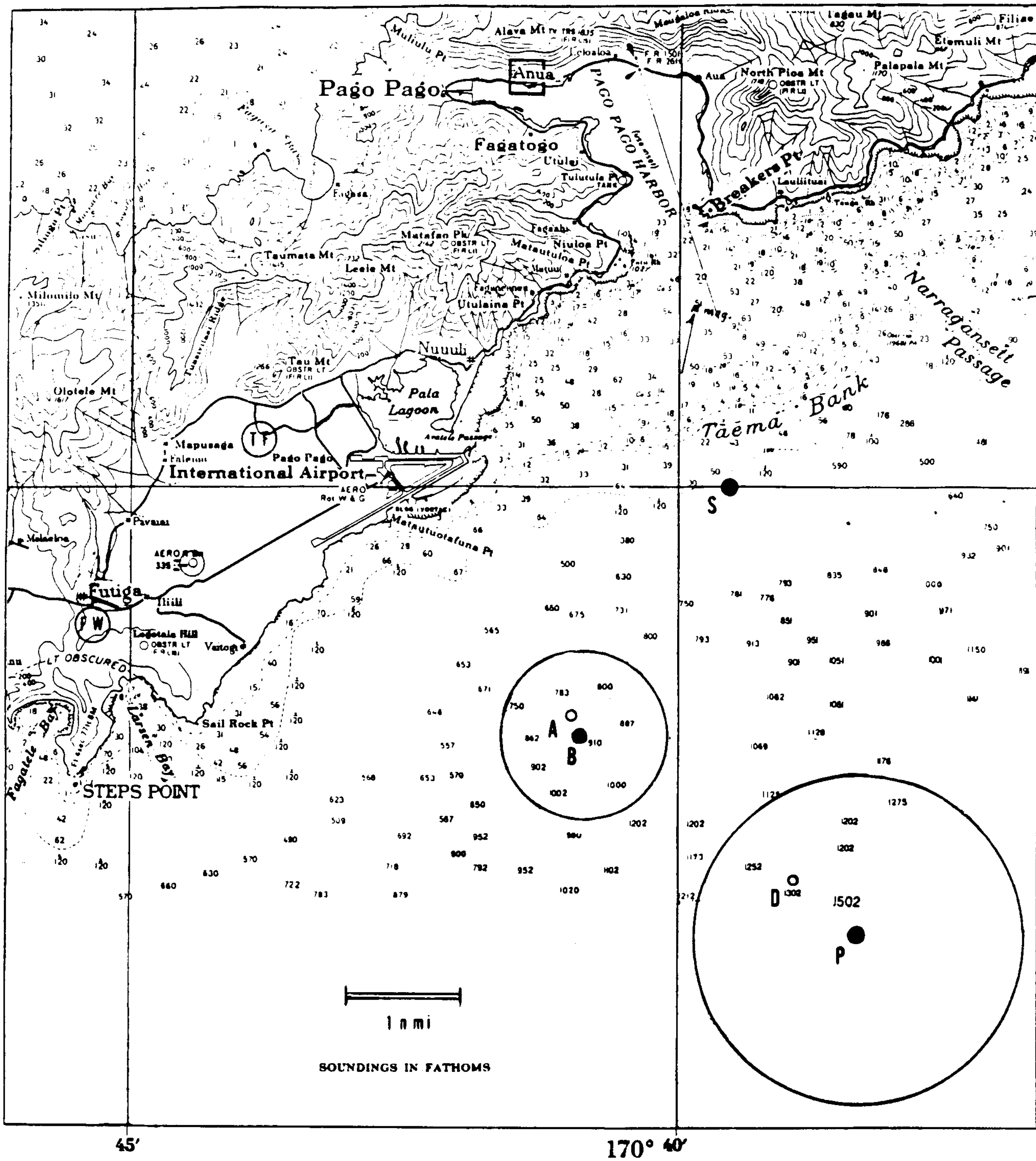

Figure III.1. Location of past, present and preferred cannery waste dumpsites.

A - Cannery waste dumpsite center, 1980-1985
B - Cannery waste dumpsite 1986- ; diameter of circle is 1.5 n mi
D - Deeper water alternative site
P - Preferred deeper water site; diameter of circle is 3 n mi
S - Shallow water alternative site
FW - Futiga land waste pit
TF - Tafunafou land waste pit
Box - Anua, location of canneries

diameter of the site is proposed to be 3.0 n mi (6.48 km), which would allow for a larger mixing zone then that of the present site. This periphery of the deeper water site would be about 0.82 n mi southeast of the margin of the present dumpsite. The entire deeper water site is outside ASG territorial waters. The present site cannot be enlarged without approaching shallow waters. The distance to be traveled by the dump vessel to the deeper water site would increase costs and turnaround time slightly. Field monitoring would be somewhat more difficult with the small boats available because navigation depends heavily on visual sightings, the time consumed would be greater, and the hazards of rough weather increased.

III.A.2. PROPOSED USE OF THE SITE

III.A.2.a. Description of Material to be Disposed

The site designation is for the purpose of allowing ocean disposal of waste materials resulting from the operation of fish canneries at Pago Pago Harbor, American Samoa by Star-Kist Samoa and Samoa Packing Co. These materials include the following:

1) Dissolved Air Flotation (DAF) sludge - a semi-solid flocculate formed from solids, oil and grease removed from process waste waters. Treatment consists of pressurizing the wastes and injecting air under pressure to produce supersaturation; return to ambient pressure causes air bubbles to form, floating the suspended solids and oil and grease to the surface for removal. Alum (aluminum ammonium sulfate) and Polyacrilimide anionic polymers are added to aid in flocculation and coagulation.

2) Precooker water - steam condensate and liquid lost from fish

during cooking in steam ovens.

3) Press water - liquid squeezed from cooked fish scrap in the fishmeal plant.

III.A.2.a.1. <u>Chemical Constituents</u>

The waste materials are high in proteins and fats, naturally occurring molecules which can readily be assimilated by the marine ecosystem. Microheterotrophic uptake (Soule and Oguri, 1979) will recycle these substances in the ecosystem. Analyses of the waste parameters in sludge from each cannery, as required by the EPA permit, are listed in Tables III.1.a. and III.1.b. along with a summary of results from 1980 through 1988.

The data for hydrogen ion concentration (pH) and bulk density were relatively stable throughout the period for which the data are presented, showing low coefficients of variation (CV) and little difference in averaged values for the two processors (Tables III.1.a. and III.1.b). The pH of the Star-Kist sludge averaged 6.0 with a CV of 4.39%. The Samoa Packing pH averaged 6.2 with a CV of 7.6%. Bulk density averaged 0.94 (CV = 7.22%) for Star-Kist and 0.99 (CV = 3.7%) for Samoa Packing. Very few outliers, defined as values exceeding ± 2 standard deviations from the mean of all values, were noted for either of these parameters.

Among other parameters reported, total phosphorus (TP), total Kjeldahl nitrogen (TKN) and Biochemical Oxygen Demand (BOD_5) were sufficiently similar in concentration in the sludge from the two companies for the differences to be masked by the variability, which was at least an order of magnitude higher for these parameters than for pH and bulk density. The average TP value for Star-Kist sludge was 1,198 mg/l (CV = 42.0%) and for TKN was 3,502 mg/l (CV = 75.0%). BOD_5 for Star-Kist sludge averages were 949 mg/l (CV = 97.7%) for TP, 2,952 mg/l (CV = 62.7%) for TKN and 57.6×10^3mg/l (CV = 70.9%) for BOD_5.

Reported values for total suspended solids (TSS), total volatile solids (TVS), oil and grease (O&G) and ammonia (NH3) concentrations were significantly different in sludge samples from the two processors. The average concentrations for these parameters were about one order of magnitude greater for the Samoa Packing sludge than for the Star-Kist sludge.

It should be noted that a dilution of 3 to 4 orders of magnitude was found in BOD_5 (Soule and Oguri, 1983) in the immediate wake of the dump vessel. This was confirmed by dilutions found in results from monitoring in 1987 and 1988 (See Appendix A). Thus, the values shown in Tables III.1.a. and III.1.b. represent those in sludge as it goes into the hold of the vessel and not after it is mixed by the vessel propeller and pumps. The parameters measured would, therefore, reach levels below the limits of detection within the dumpsite waters. Turbidity measurements in the field show a return to background levels within a few minutes to an hour in most cases.

III.A.2.a.2. Metals and Dilution Factors

Tables III.2.a. and III.2.b. summarize 1987 metals data. Pesticide analyses, which were required in 1987, are not included in the tables since results were below the limits of detection. The requirement for pesticide analysis was dropped in 1988.

The concentrations of metals in the sludge to be ocean discharged by Star-Kist Samoa and Samoa Packing Co. were not significantly different from each other except for mercury, which was approximately double for Samoa Packing as compared to Star-Kist. Variability in concentration of

Table III.1.a. Star-Kist Analyses of Sludge Ocean Dumped in American Samoa

Year	Months	pH	Bulk Density (gm/ml)	TSS mg/l*	TP mg/l	TKN mg/l	BOD5 mg/l*	O&G mg/l*	TVS mg/l*	NH3 mg/l*
1980	Oct-Dec	6.3	0.72x	219.0x	1,785	NA	188.0	19.7		
1981	Jan-Mar	6.2	0.75	4.0x	780	574	144.0	14.1		
	Apr-June	6.0	0.87	151.0	880	672	168.0	10.3		
	July-Sept	6.0	0.86	153.0	813	778	154.0	10.8		
	Oct-Dec	6.0	0.73x	78.0	661	2,554	137.0	6.5		
1982	Jan-Mar	6.0	0.83	100.0	931	907	165.0	6.8		
	Apr-June	6.1	0.86	148.0	889	1,176	150.0	18.1		
	July-Sept	5.9	0.96	110.0	850	1,059	142.0	17.7		
	Oct-Dec	6.0	0.84	112.0	897	2,138	146.0	20.1		
1983	Jan-Mar	6.2	0.90	111.0	967	1,540	143.0	19.3		
	Apr-June	5.8	0.92	92.0	10,988x	1,562	121.0	21.3		
	July-Sept	6.0	0.97	115.0	867	3,228	200.0	19.5		
	Oct-Dec	6.0	0.84	91.0	823	2,625	160.0	24.9		
1984	Jan-Mar	6.0	0.95	121.0	837	1,897	247.0	39.7		
	Apr-June	5.9	0.92	112.0	974	1,419	243.0	21.9		
	July-Sept	6.0	0.92	125.0	2,215	3	213.0	23.5		
	Oct-Dec	5.9	0.97	53.0	1,369	1,567	103.0	13.5		
1985	Jan-Mar	5.9	0.88	116.0	1,164	1,368	NA	26.0		
	Apr-June	6.2	0.91	77.0	1,342	578	138.0	19.0		
	July-Sept	6.1	0.78	101.0	1,294	1,218	269.0	23.4		
	Oct-Dec	5.9	1.00	56.0	1,113	508	73.0x	10.2		
1986	Jan-Mar	6.5	0.95	70.0	1,308	1,331	113.0	8.2		
	Apr-June	6.0	0.85	91.0	1	602	124.0	10.9		
	July-Sept	6.5	0.99	124.0	1,151	6,823	176.0	29.6		
	Oct-Dec	6.2	0.91	132.0	1,297	2,696	156.0	13.4		
1987	Jan	6.0	0.97	161.0	646	1,971	167.0	11.2		
	Feb	6.0	1.01	125.0	1,444	5,728	298.0	50.5		
	Mar	6.0	1.01	125.0	1,444	5,728	298.0	5.1	95.2	2.18
	Apr	6.0	0.91	152.0	1,014	12,600x	235.0	30.1	89.9	1.35
	May	5.1x	0.98	155.0	634	7,000	147.0	20.2	137.4	0.84
	June	6.0	0.97	107.0	1,398	6,050	179.0	50.0	102.6	2.81
	July	6.0	0.70x	176.0	2,165	6,381	244.0	16.1	162.6	1.78
	Aug	6.0	0.94	189.0x	1,732	4,975	99.5	36.0	178.1x	4.40
	Sept	5.7	0.99	118.2	1,742	1,525	337.5x	8.1	133.0	NA
	Oct	6.5	0.94	132.0	1,240	6,742	281.3	72,0x	137.0	0.61
	Nov	6.5	1.00	85.0	1,420	5,490	207.3	49.0	85.0	1.68
	Dec	5.9	1.01	109.8	2,408	8,957	168.5	52.5	138.4	3.85

Table III.1.a. (continued)

Year	Months	pH	Bulk Density (gm/ml)	TSS mg/l*	TP mg/l	TKN mg/l	BOD5 mg/l*	O&G mg/l*	TVS mg/l*	NH3 mg/l*
1988	Jan	6.5	0.91	83.3	914	10,085x	130.3	13.4	107.0	0.94
	Feb	6.5	1.03	96.4	1,674	7,630	180.7	61.5	96.8	2.35
	Mar	6.5	1.01	115.0	1,674	7,430	180.7	61.5	136.0	2.35
	Apr	5.7	1.00	94.1	686	1,880	199.0	63.0	120.0	0.79
	May	5.6	1.02	79.0	1,842	8,545	227.3	75.5x	110.5	2.09
	June	5.9	1.02	80.0	720	5,875	216.0	64.5	108.0	5.90x
	July	5.5	1.01	56.9	1,552	3,575	232.0	41.0	81.5	1.57
	Aug	5.9	0.95	82.5	1,088	6,500	216.0	57.0	81.5	2.81
	Sept	5.9	0.99	60.8	2,302	4,000	244.5	45.0	97.5	2.44
	Oct	5.4	1.01	92.0	1,002	5,788	215.0	44.5	117.0	2.78
	Nov	5.5	1.01	65.0	350	7,013	204.5	47.5	86.9	5.55x
ALL YEARS										
Range - min		5.1x	0.70x	4.0x	1	3	73.0x	5.1	81.5	0.61
max		6.5	1.03	219.0x	10,988x	12,600x	337.5x	75.5x	178.1x	5.90
Average		6.0	0.94	108.4	1,198	3,502	186.0	27.7	111.2	2.45
Std. Dev.		0.3	0.07	38.2	503	2,628	50.6	17.7	22.6	1.45
Coeff. of variation		4.39%	7.22%	35.28%	41.97%	75.04%	27.22%	63.90%	20.30%	59.04%

* mg/l x 1,000

x Outliers, as defined by EPA Region IX (P. Cotter, pers. comm.) exceed average by ± 2 standard deviations of all values. Outliers were deleted from statistical calculations but are included in the range.

Statistical References

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Table III.1.b. SAMPAC Analyses of Sludge Ocean Dumped in American Samoa

Year	Months	pH	Bulk Density (gm/ml)	TSS mg/l*	TP mg/l	TKN mg/l	BOD5 mg/l*	O&G mg/l*	TVS mg/l*	NH3 mg/l*
1980	Oct-Dec	(No ocean dumping pending final site designation)								
1981	Jan-Mar	6.1	0.99	73.9	1	70	12.6	16.7		
	Apr-June	6.1	0.99	4.0	1	336	5.8	10.4		
	July-Sept	6.1	0.99	3.1	450	70	13.0	1.1		
	Oct-Dec	6.1	0.99	94.6	340	2,204	23.8	0.5		
1982	Jan-Mar	6.1	0.99	51.2	270	722	17.9	21.0		
	Apr-June	6.1	0.99	111.3	246	4,284	24.5	41.4		
	July-Sept	6.1	0.99	94.6	4,285x	1,057	62.9	0.0		
	Oct-Dec	6.1	0.99	133.9	645	1,722	63.3	46.0		
1983	Jan-Mar	6.1	0.99	103.2	480	2,744	83.4	56.0		
	Apr-June	5.6	1.00	1.0	555	1,526	78.1	14.1		
	July-Sept	5.7	0.99	112.4	182	5,684	84.4	44.4		
	Oct-Dec	6.1	1.01x	113.5	425	3,290	100.3	21.8		
1984	Jan-Mar	6.1	1.00	141.5	115	5,320	85.2	41.4		
	Apr-June	6.0	0.97	172.5	1,342	3,500	11.1	NA		
	July-Aug	5.1x	0.96	173.5	NA	NA	NA	76.6		
	Sept-Dec		Facility shut down							
1985	Jan-Feb		Facility shut down							
	Mar-May	NA	NA	49.9	NA	NA	NA	47.6		
	June-Aug	NA	NA	NA	NA	NA	NA	NA		
	Sept-Nov	NA	NA	156.6	NA	NA	NA	21.4		
	Dec	NA	NA	NA	NA	NA	NA	NA		
1986	Jan-Mar	5.8	NA	108.8	NA	NA	2.1	28.9		
	Apr-June	6.5	0.99	97.9	192	963	8.3	72.7		
	July-Sept	7.0	1.02	85.9	584	762	18.4	59.8		
	Oct-Dec	6.8	1.06	10.8	34	515	15.0	111.3		
1987	Jan-Mar	6.5	1.05	50.9	400	1,478	68.8	58.4		
	Apr	6.2	1.01	73.3	1,690	4,400	59.6	72.9	80.7	1.20
	May	6.0	1.07x	138.0	3,390x	4,200	75.6	42.6	110.0	1.31
	June	7.0	0.99	178.0	470	3,700	88.6	151.0x	169.0	0.95
	July	6.6	1.00	112.0	1,465	5,800	67.8	94.0	94.0	1.13
	Aug	6.4	1.00	117.0	150	3,612	33.3	40.6	106.0	0.41
	Sept	6.0	0.97	156.5	1,610	4,425	80.2	68.8	134.0	1.33
	Oct	5.7	1.00	106.3	1,880	7,760x	50.0	37.0	83.7	2.60
	Nov	5.9	0.95	135.0	1,258	4,232	8.1	5.9	120.0	0.98

Table III.1.b. (continued)

Year	Months	pH	Bulk Density (gm/ml)	TSS mg/l*	TP mg/l	TKN mg/l	BOD5 mg/l*	O&G mg/l*	TVS mg/l*	NH3 mg/l*
1988	Jan	5.4	1.00	75.8	1,375	2,700	20.2	13.0	64.2	0.85
	Feb	7.5x	0.95	146.0	620	1,558	62.6	92.5	136.0	5.55x
	Mar	5.5	1.00	261.0x	1,199	2,350	117.0	160.0x	245.0x	1.52
	Apr	6.6	0.96	135.5	676	1,910	87.0	77.5	126.0	1.20
	May	6.8	0.94	174.0	816	5,110	142.0x	130.0	164.0	0.88
	June	6.6	0.99	85.5	1,260	3,270	58.0	87.0	81.4	1.39
	July	6.4	0.90x	138.5	2,278	3,593	178.5x	155.0x	132.0	0.69
	Aug	6.4	0.91	53.5	1,174	4,500	75.0	42.5	51.0	0.82
	Sept	6.4	0.90x	107.9	1,354	3,940	92.8	98.5	106.5	0.68
ALL YEARS										
Range - min		5.1	0.90	1.0	1	70	2.1	0.0	51.0	0.41
max		7.5	1.07	261.0	4,285	7,760	178.5	160.0	245.0	5.55
Average		6.2	0.99	106.1	949	2,952	57.6	56.9	117.9	1.38
Std. Dev.		0.5	0.04	53.8	927	1,851	40.9	43.0	44.7	1.14
Coeff. of variation		7.6%	3.7%	50.7%	97.7%	62.7%	70.9%	75.7%	37.9%	82.6%

* mg/l x 1,000

x Outliers, as defined by EPA Region IX (P. Cotter, pers. comm.) exceed average by ± 2 standard deviations of all values. Outliers were deleted from statistical calculations but are included in the range.

References for statistical calculations

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Wonnacott, T.H. and R.J. Wonnacott. 1969. Introductory statistics. 3rd ed. John Wiley & Sons. New York. 650 p.

Table III.2.a. Metals in Star-Kist Samoa Dissolved Air Flotation Sludge.

	Aluminum ug/l	Cadmium ug/l	Chromium ug/l	Copper ug/l	Lead ug/l	Mercury ug/l	Nickel ug/l
Star-Kist Samoa - 1987							
March	262,600	1,010	283	1,616	1,010	10.0	3,535*
April	260,000	527	1,007	2,093	1,492	0.3	553
May	335,160	595	1,009	2,391	1,294	42.0	627
June	411,280	96	330	650	45*	< 7.0	145
July	342,000	662	1,310	840	1,440	10.0	600
August	275,000	468	1,880	1,090	1,000	10.0	620
September	353,000	453	910	2,620	1,190	15.0	680
October	233,000	632	740	2,440	1,270	11.0	420
November	418,000	630	2,620*	3,690	3,080*	30.0	1,240
December	470,000	2,000*	<1,000	4,000	1,800	< 5.0	2,000
Star-Kist Samoa - 1988							
January	323,000	600	1,980	2,850	2,240	34.0	1250
February	271,000	647	1,680	6,820*	2,070	17.0	1210
March	203,700	640	2,040	3,980	2,050	20.5	1230
April	97,000	633	980	2,520	1,490	14.0	480
May	151,250	520	2,240	3,060	1,800	10.0	760
June	177,250	432	1,980	2,770	1,470	12.0	700
July	87,000	295	1,110	2,320	1,220	9.5	640
August	145,500	746	1,240	3,250	1,470	14.0	820
September	231,000	422	850	1,730	1,100	57.0*	910
October	67,500	475	1,100	2,150	1,000	26.0	1,060
November	125,500	600	990	1,790	1,140	12.0	1,340
Range - min	67,500	96	283	650	45*	0.3	145
max	470,000	2,000*	2,620*	6,820*	3,080*	57.0*	3,535*
Mean	249,511	554	1,233	2,393	1,450	15.5	991
Std. dev.	111,942	178	544	924	371	10.0	696
Coeff. of variation	44.9%	32.1%	44.2%	38.6%	25.6%	64.9%	70.2%

* Outliers, as defined by EPA Region IX (P. Cotter, pers. comm.) exceed average by ± 2 standard deviations of all values. Outliers were deleted from statistical calculations but are included in the range.

Note: MBAS, DDT, DDE, DDD, PCB 1242, 1254, 1260, test results demonstrated poor recoverability. Testing was discontinued with the EPA's concurrence. Since all results were below detection, means and standard deviations were not calculated.

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Wonnacott, T.H. and R.J. Wonnacott. 1969. Introductory statistics. 3rd ed. John Wiley & Sons. New York. 650 p.

Table III.2.b. Metals in Samoa Packing Co. Dissolved Air Flotation Sludge.

	Aluminum ug/l	Cadmium ug/l	Chromium ug/l	Copper ug/l	Lead ug/l	Mercury ug/l	Nickel ug/l
Samoa Packing Co. - 1987							
April	642,000	761	651	1,030	640	0.3	264
May	736,000	1,720	1,600	5,210	2,770*	18.0	1,750*
June	67,000	580	120*	220	190	17.7	160
July	1,350,000	552	1,590	2,090	1,700	6.0	850
August	611,000	390	1,310	2,420	960	11.0	410
September	955,000	600	1,430	3,050	1,360	24.5	570
October	835,000	< 2	1,340	40	1,620	24.0	1,117
November	228,350	688	955	3,085	1,000	28.0	450
December			No data available				
Samoa Packing Co. - 1988							
January	1,092,000	485	1,180	2,550	700	15.0	700
February	227,750	1,795	1,005	4,255	1,575	16.5	975
March	1,025,000	2,404	1,130	6,690	2,500	18.5	955
April	164,850	1,671	695	2,475	585	24.0	260
May	31,900	1,045	1,090	4,690	1,400	11.0	520
June	28,100	3,273	2,025	7,625*	1,850	46.0*	1,245
July	1,170,000	1,710	2,140	4,765	1,570	16.0	885
August	508,000	1,480	1,115	3,475	1,105	25.5	880
September	590,000	610	1,445	3,425	1,575	31.0	950
Range - min	28,100	< 2	120*	40	190	0.3	160
max	1,350,000	3,273	2,140	7,625*	2,770*	46.0*	1,750*
Mean	603,644	1,163	1,294	3,092	1,271	17.9	699
Std. dev.	414,445	823	400	1,738	560	7.9	320
Coeff. of variation	68.7%	70.7%	30.9%	56.2%	44.0%	44.3%	45.7%

* Outliers, as defined by EPA Rgion IX (P. Cotter, pers. comm.) exceed average by ± 2 standard deviations of all values. Outliers were deleted from statistical calculations but are included in the range.

Note: MBAS, DDT, DDE, DDD, PCB 1242, 1254, 1260, test results demonstrated poor recoverability. Testing was discontinued with the EPA's concurrence. Since all results were below detection, means and standard deviations were not calculated.

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Wonnacott, T.H. and R.J. Wonnacott. 1969. Introductory statistics. 3rd ed. John Wiley & Sons. New York. 650 p.

each of the metals reported was generally high, however.

Although variability was high, general patterns of concentration, at least in terms of orders of magnitude, exist to help characterize the waste. Aluminum in the hundreds of thousands of micrograms per liter, or five orders of magnitude, for both processors, was highest in concentration of all the metals reported, reflecting the use of alum as a coagulant in the treatment of the waste. Mean concentrations of chromium, copper and lead were present in the thousands of micrograms per liter range, or three orders of magnitude. However, copper concentrations in the Star-Kist sludge appeared to show a rising trend throughout the period for which data were reported. Average concentrations of cadmium and nickel were in the hundreds, and mercury concentrations averaged 25.5 ug/l for Samoa Packing sludge and 12.3 ug/l for Star-Kist.

While levels in the sludge are high for some parameters such as aluminum, the dilution factors of 3 to 4 orders of magnitude, mentioned above for BOD_5, would also apply to trace metal concentrations. Aluminum analysis is not generally required in waste dumping or effluent permits, but it's use in DAF coagulation produces high levels in the sludge and requires monitoring. Bernhard (1981) gave the hazardous concentration of aluminum for marine organisms as 1,500 ug/l and the minimal risk concentration as 200 ug/l. Petrich and Reish (1979) found the 96 hr LCP=LC_{50} and the 7 day LCP=LC_{50} to be >200 ug/l in toxicity tests of aluminum chloride ($AlCl_3$) on 2 species of polychaete worms. The $AlCl_3$ they used is water soluble whereas aluminum ammonium sulfate (alum) tends to remain complexed to particles that would readily disperse in the plume, further reducing risk. An immediate dilution of the levels found in the sludge by 3 to 4 orders of magnitude in the wake of the vessel, plus subsequent mixing within the dumpsite perimeter, would render the metals undetectable and harmless to marine life.

According to calculations of Limiting Permissible Concentration (LPC), a theoretical dilution of 0,0004% (1:250,000) is achieved within the dumpsite (See Section III.A.2.b). This would result in levels of 200 mg/l, for example, being reduced to 0.08 mg/l, within the dumpsite.

III.A.2.a.3. Quantities of Waste

Total gallonages dumped each month are shown in Table III.3. It can be seen that the permitted quantity of 256,900 gals/day is not being approached since the monthly average in 1987 was 891,616 gals. Quantities in 1985, 1986 and 1987 were larger than in prior years, due in part to increases in capacity and production. Lower quantities reflected, in some instances, periods in which plants were closed for repair, remodelling or expansion. Figure III.2. illustrates the variability in disposal levels based on quarterly averages, and also shows the transition to increased capacity after 1984.

III.A.2.b. Specific Gravity of Samoan Cannery Waste

III.A.2.b.1. 1987 Tests

Waste samples from the holding tanks of Star-Kist Samoa and Samoa Packing facilities, as well as samples of the mixed waste from the holding tanks of the disposal dump vessel, were frozen and shipped to Los Angeles for toxicity testing three times during 1987. Each of these samples was thoroughly mixed prior to bioassays and a portion of each sample was tested for determination of specific gravity. Empirical tests of settleable material contained in three of the waste samples were also conducted.

The methods used to determine specific gravity are described in Standard Methods for the Examination of Water and Wastewater, (Anon.,

Table III.3. Sludge Ocean Dumped in American Samoa in Gallons with Annual Average, Standard Deviation and Coefficient of Variation.

Year	Month	SK-Samoa	VC/SAMPAC	Total
1980	Oct		0	
	Nov	86,700*	0	86,700*
	Dec		0	
1981	Jan		130,375	
	Feb	701,000*	246,875	1,295,125*
	Mar		216,875	
	Apr	269,950	311,625	581,575
	May	265,800	416,000	681,800
	June	304,950	174,000	478,950
	July		311,625	
	Aug	1,021,200*	292,975	1,946,610*
	Sept		320,810	
	Oct	347,200	249,500	596,700
	Nov	268,800	256,000	524,800
	Dec	205,800	306,000	511,800
1982	Jan	193,200	48,000	241,200
	Feb	210,600	159,375	369,975
	Mar	297,200	193,750	490,950
	Apr	334,800	322,000	656,800
	May	63,000	271,000	334,000
	June	253,250	237,000	490,250
	July	274,200	268,125	542,325
	Aug	174,000	110,000	284,000
	Sept	247,800	187,686	435,486
	Oct	243,000	292,702	535,702
	Nov	170,000	273,750	443,750
	Dec	268,926	237,625	506,551
1983	Jan	273,200	209,450	482,650
	Feb	328,200	208,750	536,950
	Mar	319,200	258,750	577,950
	Apr	327,400	215,000	542,400
	May	384,000	245,625	629,625
	June	290,400	305,000	595,400
	July	380,000	172,711	552,711
	Aug	202,100	143,750	345,850
	Sept	277,500	135,000	412,500
	Oct	398,400	199,375	577,775
	Nov	378,600	106,250	484,850
	Dec	250,800	225,625	476,425
1984	Jan	171,400	202,375	373,775
	Feb	293,600	197,500	491,100
	Mar	306,200	165,000	471,200
	Apr		120,625	
	May	854,800*	120,625	1,289,800*
	June		193,750	
	July	241,200	191,750	432,950
	Aug	322,300	215,985	538,285
	Sept	347,900	0	347,900
	Oct	470,800	0	470,800
	Nov	302,100	0	602,100
	Dec	850,900	0	850,900

Year	Month	SK-Samoa	VC/SAMPAC	Total
1985	Jan	552,000	0	552,000
	Feb	576,000	0	576,000
	Mar	396,000	128,542	524,542
	Apr	663,856	310,361	974,217
	May	652,947	299,035	951,982
	June	528,000	272,482	800,482
	July	648,000	363,579	1,011,579
	Aug	528,000	277,948	805,948
	Sept	432,000	234,897	666,897
	Oct	792,000	360,965	1,152,965
	Nov	792,000	408,850	1,200,850
	Dec	624,000	336,700	960,700
1986	Jan	528,000	360,750	888,750
	Feb	480,000	336,700	816,700
	Mar	576,000	384,800	960,800
	Apr	662,000	432,900	1,094,900
	May	576,000	456,950	1,032,950
	June	432,000	484,500	916,500
	July	528,000	658,125	1,186,125
	Aug	528,000	528,149	1,056,149
	Sept	552,000	454,466	1,006,466
	Oct	672,000	454,466	1,126,466
	Nov	600,000	484,515	1,084,515
	Dec	384,000	496,560	880,560
1987	Jan	384,000	398,045	782,045
	Feb	456,000	451,521	907,521
	Mar	480,000	603,567	1,083,567
	Apr	552,000	507,941	1,059,941
	May	516,000	539,086	1,055,086
	June	504,000	543,051	1,047,051
	July	408,000	403,692	811,692
	Aug	475,200	298,448	773,648
	Sept	540,000	412,346	952,346
	Oct	504,000	365,631	869,631
	Nov	408,000	389,060	797,060
	Dec	516,000	321,192	837,192
1988	Jan	276,000	319,424	595,424
	Feb	456,000	377,586	833,586
	Mar	480,000	434,764	914,764
	Apr	444,000	272,259	716,259
	May	484,000	277,620	761,620
	June	507,000	414,770	921,770
	July	421,000	299,494	720,494
	Aug	468,000	398,826	866,826
	Sept	362,100	242,890	604,990
	Oct	542,000	NA	
	Nov	565,000	NA	
	Dec	478,000	NA	

* Value given is for a three month period. Aveage of this value was used to compute statistics for SK-Samoa and for Total for the period.

Table III.3. (continued)

Year		StarKist Samoa	Samoa Packing	Total
1980	Insufficient data were reported to permit statistical analysis.			
1981	Average	282,058	269,388	551,447
	Standard Deviation	48,654	71,802	90,816
	Coefficient of variation	17.25%	26.65%	16.47%
1982	Average	227,498	216,751	444,249
	Standard Deviation	68,480	76,953	114,016
	Coefficient of variation	30.10%	35.50%	25.66%
1983	Average	317,483	202,107	517,924
	Standard Deviation	58,370	53,600	77,793
	Coefficient of variation	18.39%	26.52%	15.02%
1984	Average	346,700	175,951	489,001
	Standard Deviation	165,849	34,593	128,225
	Coefficient of variation	47.84%	19.66%	26.22%
1985	Average	598,734	299,336	848,180
	Standard Deviation	117,813	74,792	221,126
	Coefficient of variation	19.68%	24.99%	26.07%
1986	Average	543,167	461,073	1,004,240
	Standard Deviation	80,909	80,589	107,858
	Coefficient of variation	14.90%	17.48%	10.74%
1987	Average	478,600	436,132	914,732
	Standard Deviation	52,192	90,315	114,850
	Coefficient of variation	10.91%	20.71%	12.56%
1988	Average	456,925	253,136	770,637
	Standard Deviation	74,410	156,970	115,720
	Coefficient of variation	16.28%	62.01%	15.02%
TOTAL	1980-1988			
	Average	379,888	292,886	602,100
	Standard Deviation	176,720	132,598	309,945
	Coefficient of variation	46.52%	45.27%	51.48%

For statistical calculation references see Table III.1.a.

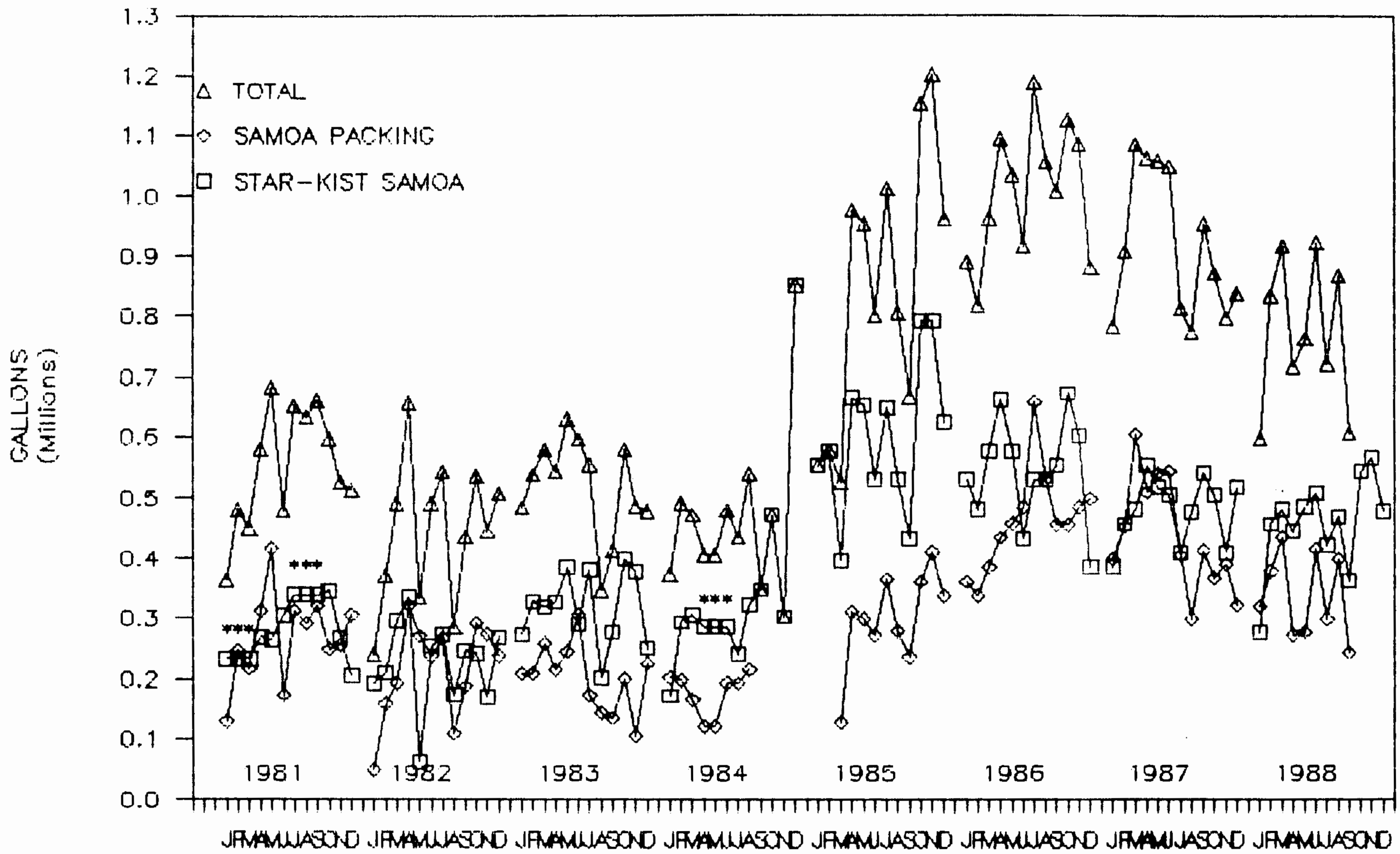


Figure III.2. Total gallonage dumped, by month (*Data available for 3 month average only)

1985). All measurements were conducted in duplicate, and samples of distilled water were also measured as part of each run to establish a reference. The specific gravity of a sea water sample collected in the San Pedro Basin, southern California, was also determined. Diluted aliquots of each of the waste samples were placed in separatory funnels for one hour to determine the extent of fractionation into floating and settling portions.

The data obtained during these measurements and the specific gravity determinations are presented in Table III.4. The average specific gravity of the replicate determinations is also listed and, since the wastes are to be disposed of at sea, this average is compared to the specific gravity of the sea water sample measured.

All waste samples showed a slightly higher specific gravity than distilled water but varied closely around that of sea water, departing from that value by only a few parts per thousand. This indicates that the material will tend to disperse in near surface waters upon discharge, a situation that is borne out by visual observation during previous and presently ongoing monitoring of the waste field.

III.A.2.b.2. 1982 Tests

Specific gravity and settling rate tests were conducted in 1982 on DAF sludge from American Samoa. In tests in a 14 ft column, 92% of the test material was still in the surface layer after 30 min, and only 0.5% was on the bottom. After 120 min, 72.3% of the test material was still in the surface layer and 7.1% was on the bottom. The rest was suspended in a mixed layer in the middle of the column (Soule and Oguri, 1983).

III.A.2.c. Site Capacity

Site capacity has been determined by two methods: 1) on the basis

Table III.4. Specific Gravity of Samoan Cannery Waste.

Sample		Temp. °C	Vol. ml	Wt. mg	Wt./Vol.	F*	Spec. Grav.	Avg	Avg. SG/ Sea water
Distilled Water		21.9	246	244.16	0.9925	0.9979	0.9904	0.989	
		21.9	250	247.23	0.9889	0.9979	0.9868		
		19.2	100	98.96	0.9896	0.9983	0.9879	0.989	
		19.2	100	99.20	0.9920	0.9983	0.9903		
		19.0	100	99.13	0.9913	0.9984	0.9897	0.990	
		19.1	100	99.17	0.9917	0.9984	0.9901		
Sea Water		21.4	247	252.57	1.0226	0.9980	1.0205	1.019	
		21.4	242	246.54	1.0188	0.9980	1.0167		
Waste	Star-Kist - May	22.0	392	399.52	1.0192	0.9979	1.0170	1.019	1.000
		22.0	423	432.83	1.0232	0.9979	1.0211		
	Samoa Packing - May	20.8	412	413.67	1.0041	0.9981	1.0021	1.002	0.984
		20.9	400	401.83	1.0046	0.9981	1.0027		
	Mixed - May	21.4	400	404.76	1.0119	0.9980	1.0099	1.014	0.996
		21.4	406	414.52	1.0210	0.9980	1.0189		
	Star-Kist - July	21.6	386	395.4	1.0244	0.9980	1.0223	1.023	1.004
		21.5	418	428.5	1.0251	0.9980	1.0231		
	Samoa Packing - July	21.9	380	377.57	0.9936	0.9979	0.9915	0.990	0.972
		21.7	434	429.98	0.9907	0.9979	0.9887		
	Mixed - July	22.1	406	406.68	1.0017	0.9979	0.9996	1.002	0.984
		22.1	403	405.95	1.0073	0.9979	1.0052		
	Star-Kist - September	20.0	330	338.35	1.0253	0.9982	1.0235	1.018	0.999
		19.8	318	322.49	1.0141	0.9982	1.0123		
	Samoa Packing - September	20.2	336	345.55	1.0284	0.9982	1.0266	1.021	1.003
		20.2	340	346.2	1.0182	0.9982	1.0164		
	Mixed - September	21.6	360	367.44	1.0207	0.9980	1.0186	1.021	1.002
		21.6	360	368.83	1.0245	0.9980	1.0225		

* F = Temperature correction factor

of the MPRSA Limiting Permissible Concentration; and 2) by the Koh-Chang numerical model study summarized in Section III.A.2.d., and presented in Appendix B.

III.A.2.c.1. Limiting Permissible Concentration (40 CFR 227.27(a)(2))

As required by the MPRSA (40 CFR 227.27) the constraints on ocean disposal are to be determined based on the demonstrated toxicity of the .

Toxicity tests were conducted on wastes from Star-Kist Samoa and from Samoa Packing, and on mixed samples from the holding tank of the disposal vessel prior to ocean dumping (SOS-Environmental, Inc., 1987j). These tests, conducted in three separate series used *Fundulus parvipinnis*, the California killifish, *Acanthomysis sculpta*, a mysid shrimp, and *Euryrdice caudata*, a planktonic isopod, as test species. The most sensitive of the organisms was *Acanthomysis sculpta*, as it was in earlier tests (Soule and Oguri, 1983a). The earlier tests reported an $LCP=LC_{50}$ for *Acanthomysis* as 0.04% of the Star-Kist waste tested at that time. The 1987 test of *Acanthomysis* for the three waste samples showed a range of $LCP=LC_{50}$ values from 0.04%, for Samoa Packing test series 2, to 0.27% for the mixed sample test series 3 (See Appendix A.2, Table 1). The Limiting Permissible Concentration (LPC), based on the worst case, that of Samoa Packing Co. test series 2, is 0.01 X 0.04% or a 0.0004% concentration of the waste, unchanged from the 1983 test value.

III.A.2.c.2. Release Zone (40 CFR 227.28)

The release zone, "...the area swept by the locus of points 100 meters from the perimeter of the conveyance...", was 200 m plus 8.1 m, the beam of the dump vessel then being used, or a total of 208.1 m in width. The length of the release zone is based on the capacity of the dump vessel, the rate at which her tank is pumped and the speed of the vessel during dumping operations. The pumping rate, 140 gallons per minute per knot at 5 knots equals 700 gallons per minute. This would require 34.3 minutes to empty the 24,000 gallon tank aboard the vessel. The vessel at 5 knots would cover 5.3 kilometers in that period. The area of the release zone, based on width multiplied by length, is 1,102,930 m^2. A change in beam width from 8.1 m to 6.7 m for the *Mataora* would reduce the release zone by less than 1 percent, not a significant change.

III.A.2.c.3. Initial Mixing (40 CFR 227.29)

In the absence of a detectable thermocline within 20 m of the surface in the area of the proposed dumpsite, the depth of the initial mixing volume is assumed to be 20 m (Soule and Oguri, 1983a). The initial mixing volume is, therefore, the Release zone area multiplied by 20, or 22,058,600 m^3.

III.A.2.c.4. Conclusions 40 CFR 227.29 (a)

The concentration of the waste within the initial mixing volume will distribute the 24,000 gallons capacity of the tank aboard the dump vessel through the initial mixing volume of 22.06×10^6 m^3 in the 1.5 n m diameter site to yield an overall concentration of 0.0004%, the LPC.

The theoretical site capacity, of the present site, using calculations based on toxicity test LPC, is 128,000 gals. This is adequate to accommodate two trips per day, with the possible expansion of vessel capacity to about 50,000 gals or more trips. However, if the permitted quantity of 256,000 gals were dumped each day, it would equal the LPC with no margin for error. This quantity would not be dumped except under emergency circumstances such as backlog from vessel breakdown or plant malfunction. Increasing the site diameter at the deeper water preferred site to 3.0 n mi provides for a 2-fold safety factor. The following calculations show the maximum gallonage that could be dumped, based on the LPC-calculated dilution of 0.0004%, using various dumpsite diameters:

1.0 n mi	56,931 gals	2.5 n mi	355,857 gals
1.5 n mi	128,095 gals	3.0 n mi	512,379 gals
2.0 n mi	227,723 gals	3.5 n mi	697,404 gals

III.A.2.d. Numerical Model Study

In the numerical model study of the present dumpsite, using the modified Koh-Chang model, (Appendix B) Koh and Lee found that under zero current conditions the 24,000 gals of waste would fill and remain within the 1.5 n mi diameter dump circle, diffusing equally from the center of the site. It reaches the dilution of 1:250,000 (0.04%) required, based on bioassay tests (See Appendix A.2). Under a 0.2 knot current, in winter, the plume would not fill the circle but would form a long ellipse shape, reaching the required dilution about 0.75 n mi outside the dumpsite (See Appendix B). Under a 0.4 knot current it would extend about 0.85 n mi beyond the circle. In summer a longer, more slender plume would extend 1.45 n mi beyond the perimeter in reaching the required dilution. No waste is measurable at that dilution. Under worst case conditions, a current to the northwest, the plume would reach the longshore current outside the 120 fm line but not reach shore, although it would be closer to shore than is considered prudent. If the longshore current breaks up or reverses, wastes might reach the airport reefs.

When the diameter was enlarged to 3.0 n mi, for the deeper water site, the plume would be retained within the perimeter of the site under most conditions. However, enlarging the present site to that diameter might bring the plume to the 120 fm contour under routine dumping conditions, closer to shore than is considered prudent. Therefore the site as presently centered can not be enlarged to that diameter. The deeper water thus becomes the preferred site. If dumping takes place near the periphery (0.3 n mi inside) upcurrent, the plume will be fully contained within the preferred site (See Appendix B, the model study, for illustrations).

III.A.3. FEASIBILITY OF SURVEILLANCE

III.A.3.a. Difficulties of Surveillance

Surveillance of ocean activity off American Samoa is difficult at best, since the waters are rough and the weather variable, navigation and communication systems are rudimentary, and Coast Guard rescue services are non-existent. The availability of vessels large enough to perform monitoring in rough weather is poor, and those vessels available lack power supply for use of electronic gear or deck hoists for sampling, as well as deck shelter for equipment.

The equipment considered to be basic for standard monitoring programs was not available in American Samoa and had to be brought in from the mainland. The InterOcean current meter, built to interface on shipboard with a computer, had to be downrigged to produce a deck readout since there is no sea-going computer equipment available in American Samoa. There are no service facilities for this instrument except in San Diego. Electronic sensors in the Martek instruments which measure temperature, salinity, dissolved oxygen, pH and light transmittance are fragile and require continuing care in the field and laboratory, as well as hand carrying to Los Angeles for repairs, since there is no service available in American Samoa or in Hawaii.

III.A.3.b. Feasible Methods of Surveillance

The public has opportunities for observing the ocean dumping activity since the dump vessel is readily visible as it transports the wastes and can be seen at the dumpsite in good weather. Furthermore, the dumpsite is clearly visible from the control tower of Pago Pago International Airport, and small planes overfly the site en route to the Manua Islands to the east or to Western Samoa, to the west. There is a Coast Guard liaison officer present in Pago Pago for enforcement if violations are documented.

III.a.3.b.1. Present Site

Over the long term, field monitoring of the scope included in the Research Permits should not be necessary, and the difficulties of using electronic equipment have been demonstrated. The following procedures are considered to be feasible for surveillance of the present site:

1) During the functional life of the current meter, measurements should be continued on a monthly basis. A measurement of direction before the start of dumping and at the end could be made from the dump vessel.

2) Ammonia-N can be used to map the dispersal and degradation of the plume, as was demonstrated by Soule and Oguri (1984,1986). This requires only that water samples be taken in the field and placed in acidified bottles, chilled and returned to the cannery laboratory. Bottles can be stored in a refrigerator until the laboratory is ready to perform analyses using an Orion ammonia probe and a pH meter. This is a much more accurate test than the traditional five day biochemical oxygen demand (BOD_5) test which requires a larger sample, chilling on board and immediate processing when the sampling vessel returns, usually in the late afternoon. Soule and Oguri (1984,

1986) demonstrated the positive correlation of Ammonia-N and BOD_5, and recommended use of the former in monitoring.

3) Temperature and salinity data have proven interesting to scientists, especially since the effects of El Niño - Southern Oscillation (ENSO) events were discernible in the data (See Sections III.B.1 and III.B.2). However, there is no thermocline or halocline at the depths studied, and no significant differences were found in the values between dumpsite stations or controls. The tropical thermocline is generally found between 100 and 200 m. (See Section III.B.3.c). Thus, there is little need from the regulatory viewpoint for continuing to record these data, given the difficulties in keeping the instrumentation functional. A simple reversing thermometer would provide adequate data, if needed, or the requirement could be dropped altogether.

4) Dissolved oxygen has been of critical interest, especially since the saturation levels in tropical waters are close to the requirements of some species of fish. Waters off American Samoa have been supersaturated on some occasions, reflecting the turbulent mixing in the dumpsite area. Efforts to find an oxygen sag in the plume required following the dump vessel as closely as possible in order to record a transitory oxygen sag (Soule and Oguri, 1983a) and levels generally do not fall below the ASG water quality standard of 5 ppm (unless the natural background level is less). Otherwise, oxygen levels do not appear to be depressed by the plume. Continuing to measure this parameter with fragile electronic equipment is

probably unnecessary.

III.A.3.b.2. Deeper Water Site

The deeper water site is outside American Samoa territorial waters so that determining compliance with ASG water quality parameters is not required. Nevertheless EPA requires monitoring to determine that the waste is adequately diluted and dispersed within the dumpsite to reach ambient conditions at the perimeter. The new permit monitoring program will test eliminating the use of a small boat because it is no longer considered necessary to have as many measurements within the plume as were performed during the research permit. The longer distance of the site from shore would increase the difficulty of using small boats.

Sampling from the dump vessel itself will be tested under the permit to be issued, which will require installing a davit or boom to raise and lower the water quality sampling devices. Electronic probes will not be required because of their fragility and difficult maintenance. The dump vessel will not transit the dump plume, but will take samples before dumping begins and on the downcurrent edge after dumping is concluded..

As a check on the dilution factor, one set of grab samples could be made from the dump vessel before dumping and another set on the downstream margin of the plume after dumping is completed.

Parameters required for analysis in quarterly sampling of the waste prior to dumping should include those listed in Tables III.1. and III.2., including trace metals but not pesticides and PCBs (See Section IV.E. for details of the site management plan).

III.A.4. EXISTENCE AND EFFECTS OF CURRENT AND PREVIOUS DISCHARGE AND DUMPING IN THE AREA

The principal effect of the ocean discharge has been the positive one of eliminating the serious impacts generated by land disposal. Ocean disposal has been in operation since 1980. The quantities dumped in that period are given in Table III.3. There have been no discernible permanent effects on the water quality of the ocean in or near the dumpsite. The water color at control sites was a deep oceanic blue (Forel-Ule Scale 1) in 1982 - 1983 monitoring during the ENSO event, and has been a light oceanic blue (Forel-Ule Scale II or III) in 1987. This may reflect increased microheterotrophic activity from long term dumping, or from increased terrestrial rainfall runoff, but the lack of greenish hues indicates that phytoplankton eutrophication has not occurred.

Initially in 1980 when ocean dumping began, some individuals claimed that the wastes were coming ashore, and that odors also came ashore. No physical evidence of waste onshore has been collected or dates documented of any such occurrences, although D. Itano of the ASG states that he has observed and smelled the waste on shore (See letter, section V.D).

Because of the nature of the forage fish and pelagic fish, coupled with the depth of water and slope of the bottom, the wastes may or may not have enhanced the sport fishery or gleaning activities along the shores. Increased population pressures on the gleaning resources would mask any enhancement that might have occurred. However, there is no evidence that the waste dumping has had any deleterious effect on the ocean waters or the reef and shore habitats.

III.B. PHYSICAL ENVIRONMENT

III.B.1. METEOROLOGY AND AIR QUALITY

III.B.1.a. Meteorology

The Pacific Ocean dominates both atmospheric and oceanic climate in American Samoa. Predominantly easterly trade winds, which blow from east to west and the periphery of the westerly flowing South Equatorial Current are the major factors.

The ambient air quality of the Pago Pago, American Samoa region is not well documented as compared to the air quality information available in urban portions of the mainland United States. However, meteorological conditions have been well documented and a weather station is located at Pago Pago International Airport on Tutuila Island. When a U.S. Naval Station was operated in Pago Pago Harbor, observations of tide and weather were collected there, but the airport area is drier than the harbor area, making the data less comparable. Data have been compiled from ships' observations offshore from Pago Pago Harbor, collected between 1854 and 1978, and averaged in the U.S. Navy Marine Climatic Atlas of the World, South Pacific Islands [U.S. Naval Weather Service (USNWS), 1979]. Averaging of such an extensive number of data points tends to mask the variability and long term trends of conditions. The meteorological information contained herein has been summarized from this source. The meteorological conditions at the proposed ocean dumping site are assumed to be similar to those represented in the atlas.

III.B.1.a.1. Air Temperature

The annual average air temperature (USNWS, 1979) is 27^{O}C (80.6^{O}F), with temperatures averaging 27.2^{O}C (81^{O}) during the southern hemisphere winter months of June through November, and 28.0^{O}C (82.4^{O}F) during the summer months of December through May. Average monthly temperatures are relatively unaffected by changing winds and show a range of standard deviations of 0.9°C to 1.5°C for winds from various directions.

III.B.1.a.2. Rainfall

Rainfall is frequent, and as is often typical of tropical islands, there are frequent showers. The wettest months are November through May, and the other months represent the "dry" season, which is often quite wet. Most of the heavy rain is associated with winds from the westerly or northerly sectors, indicating that the wet season is the period when the easterly trade winds are least dominant. Rainfall varies greatly in different areas. The Pago Pago airport has 125.4 inches per year, the harbor has 200 inches per year, and Mt. Alava and Tau Mountain (Figure III.3.) west of the harbor, have 250 and 300 inches per year respectively (ASF, 1981d). Rainfall has been reported for January, the wettest month, that varies from 5 to 65 inches [U.S. Defense Mapping Agency (U.S.DMA), 1985]. The Pago Pago region has a relative humidity of 80% or greater more than 50% of the time. Other weather conditions, such as wind and visibility, are seasonally variable.

III.B.1.a.3. Winds

Easterly trade winds dominate air flow in the area, with over 50% of all winds being easterly (from the east, northeast or southeast). During the winter months of May through October this easterly dominance exceeds 80%, with dominant wind flow being slightly more southerly than during the other months. Wind data for December and June are given in Figure III.4. During the storm season (December-March), wind directions principally range from northerly to southeasterly. During the rest of the year, the prevailing winds are more consistently easterly and southeasterly (trade

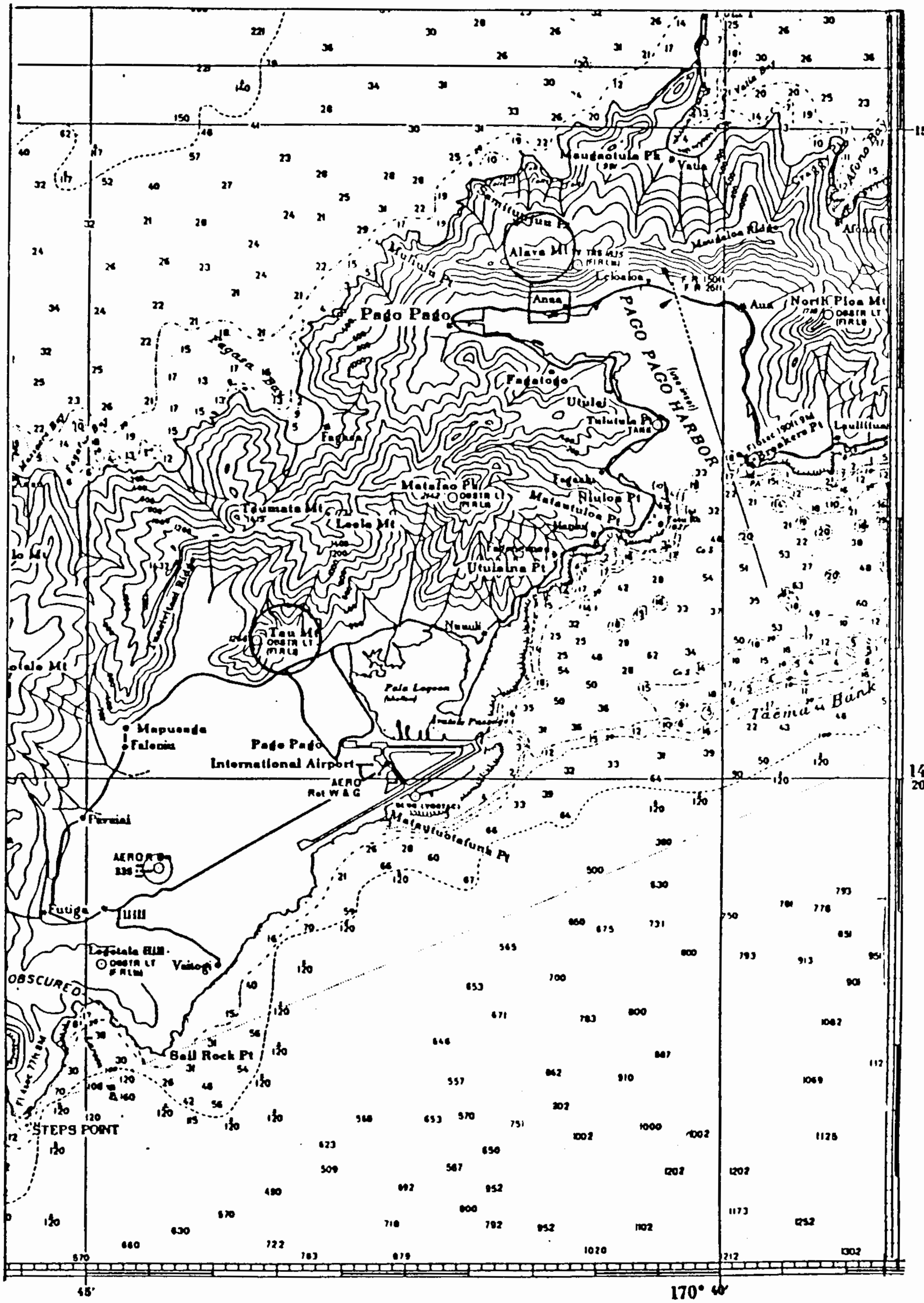


Figure III.3. Rainfall records show 125.4 inches per year at Pago Pago Airport, 200 inches at Pago Pago Harbor and 250 to 300 inches at Mt. Alava and Tau Mountain (circles).

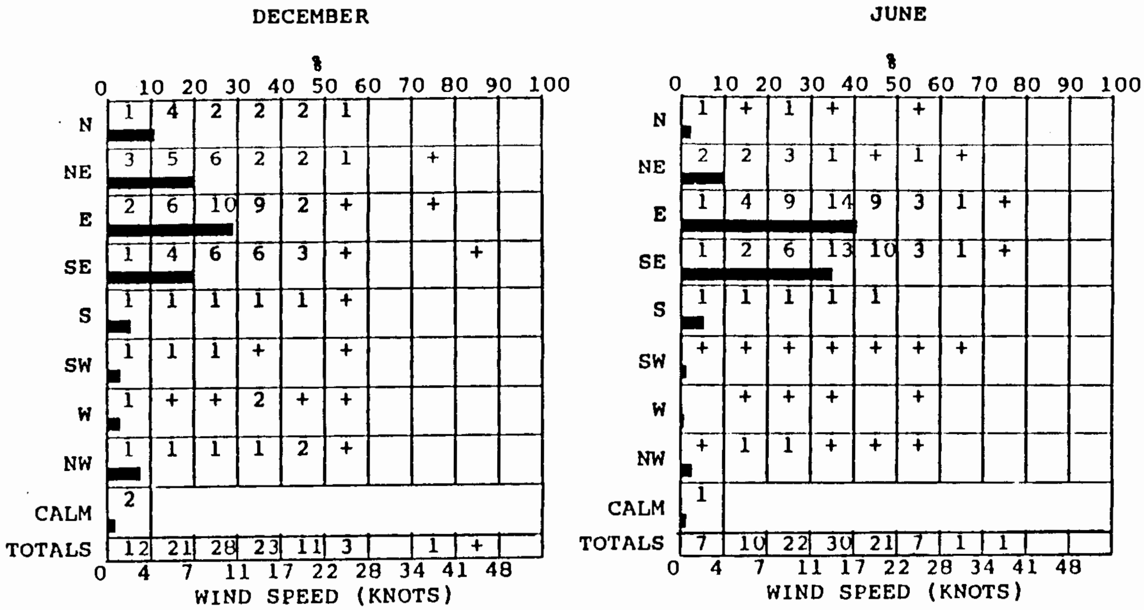


Figure III.4. Mean wind direction and speed, Pago Pago, American Samoa.

Notes: Direction Frequency (top scale): Bars indicate percent frequency of winds observed from each direction. speed frequency (bottom scale): Printed figures represent percent frequency of wind speeds observed from each direction; + indicates <.5% but >0

Source: U.S. Navy Marine Climatic Atlas of the World, Volume V. South Pacific Ocean, NAVAIR 50-IC-532. Naval Weather Service, October 1979.

winds) and are generally stronger. There are very few calm days at Tutuila Island. Winds tend to be stronger in the winter months (i.e., June). Winds from the south, southwest and west occur most infrequently. Wind velocities average 10.6 knots (k) throughout the year and are strongest during the months of June through October, averaging 12.0 k during this period. The average for the other months is 9.5 k.

High winds, with velocities in excess of 22 knots occur throughout the year but are most frequent during the winter months. These winds are generally easterly during the winter and are more northerly and westerly during the summer. Hurricanes, such as Hurricane Zuman in April 1987, are infrequent and seasonal but can devastate both land and coastal areas. Winds from the north often indicate the onset of stormy weather, and make sea conditions enroute or at the dumpsite quite variable and rough, with some areas in the lee of the mountains and others subjected to gusts through the "windows" in mountain passes. A rare south wind storm which lasted for several days during the July 1982 monitoring efforts brought a sudden drop in air temperature to about 21^{o}C (70^{o}F) and heavy rains. Coupled with seasonally extreme low tides, seas were so rough that it was impossible for small boats to leave the southward facing harbors, and larger vessels such as the dump boat and long liner fishing boats had great difficulty making way into waves breaking across Taema Bank higher than the vessels.

The 1982-1983 period of the El Niño-Southern Oscillation (ENSO) event produced profound changes in the large oceanic upper atmosphere circulation cells that occur circumtropically between 30^{o} N and 30^{o} S (Tourre, 1987). The large Pacific cell was displaced eastward exactly over the eastward extension of an area of equatorial waters warmer than

$29^{o}C$. Anomalies in the zonal circulation are illustrated in Figures III.5.a,b, from Tourre. While the anomalies at $170^{o}40'$ during June, July and August were not as severe as those to the east and west, the anomaly in December, January and February 1982-1983 was extreme. Zonal wind anomalies are postulated as the triggering mechanism for ENSO events, driving the changes in oceanic circulation (Shiying and Jinshu, 1987), discussed in section III.B.2.d. The ENSO changes may have been the cause of differences in drogue and plume direction in 1982 and 1983 (See Section B.2.c.), and in species composition (e.g., D.F. and J.D. Soule, 1985).

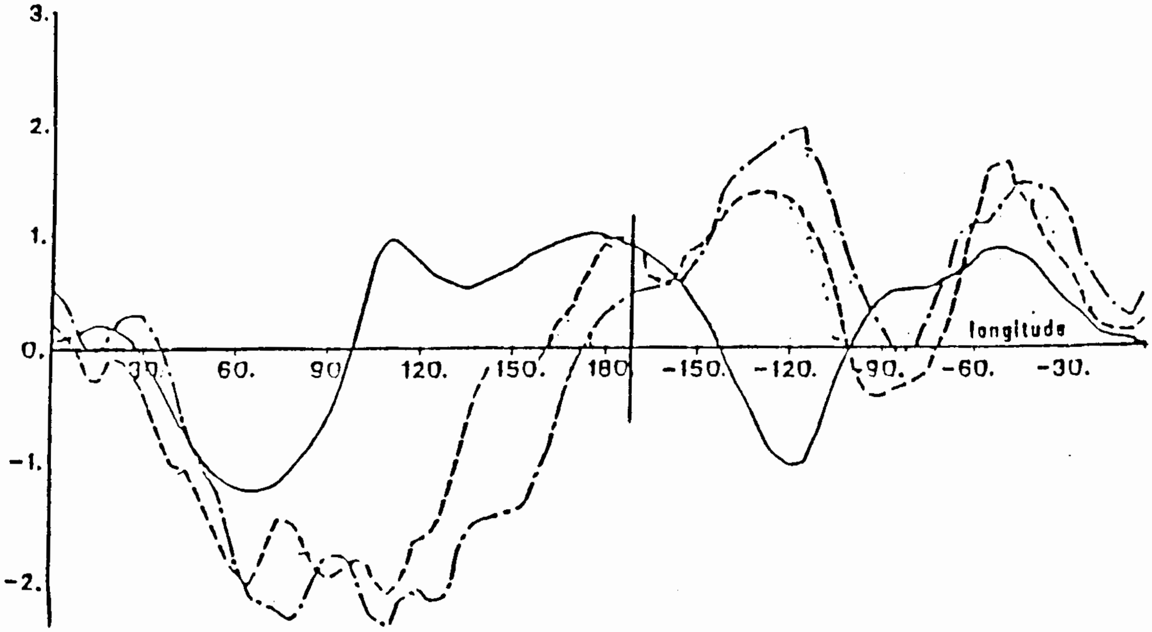
III.B.1.a.4. Visibility

Visibility in the Pago Pago area is greater than 5 n mi most of the time and greater than 10 miles about 60% of the time. However, there are occasions when the visibility is significantly reduced. For example, visibility is less than 2 n mi about 0.15% in June and about 2.0% of the time in December, usually associated with precipitation. Since these data represent long term averages, they tend to suggest that visibility is less of a problem for navigation than it is, based on field experience, during monitoring of the waste field, when there are short intervals in time and space for determining positions.

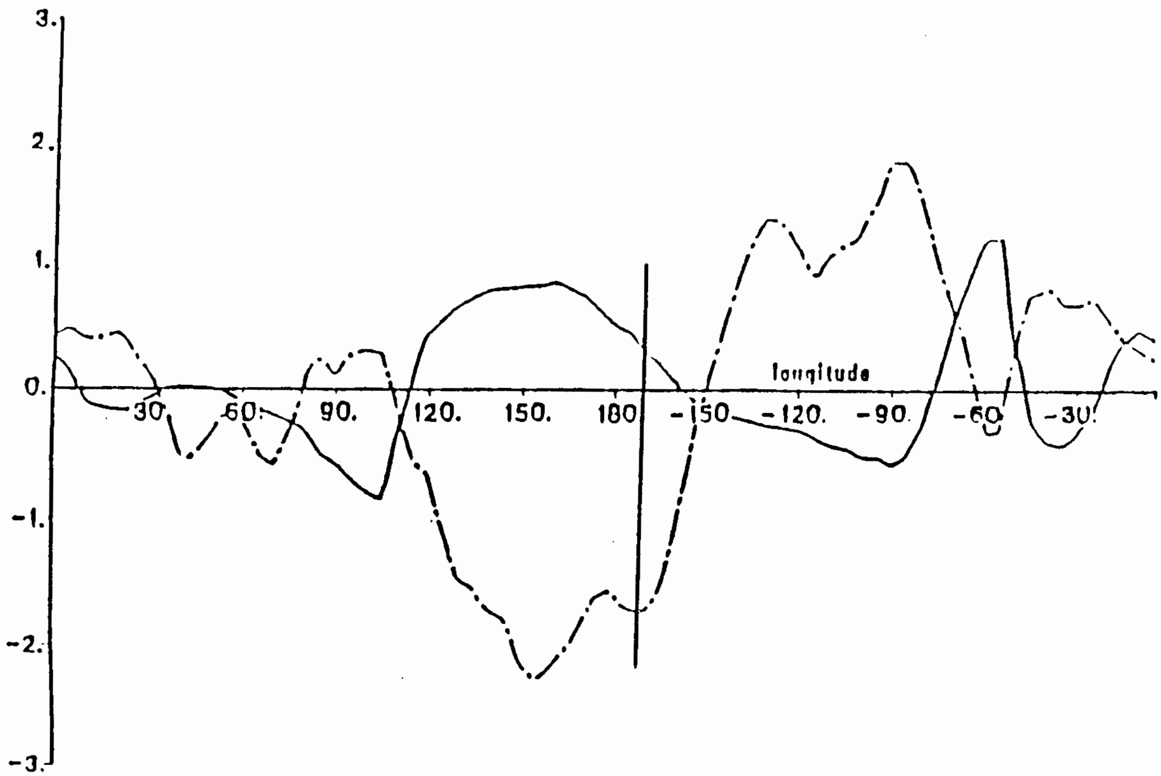
III.B.1.b. Ambient Air Quality

The ambient air quality in the Pago Pago area and the proposed ocean dumping site is considered to be good, and federal ambient air quality standards are believed to have been attained. The good ambient air quality in the region is due to a number of factors including:

1) constant wind flows;
2) few days of stagnant air flows;
3) absence of constraining physical landforms; and



a. June, July, August 1982



b. June, July, August 1983

Figures III.5.a.,b. The anomalies of the zonal wind circulation index during JJA 1982 (dotted-dashed line) and JJA 1983 (dashed line) compared to "normal" JJA (bold Line) (III.5.a.). The anomalies during DJF 1982-83 (dashed line) compared to "normal" DJF (bold line) (III.5.b.) (after Tourré, 1985). (vertical line indicates longitude of American Samoa).

4) the absence of a significant number of mobile and stationary sources of air pollutants.

The ASG primary ambient air quality standards are the same as the federal standards (See Table III.5.a).

III.B.1.c. Air Quality Impacts

The impacts on air quality at the proposed designated ocean dumping site are minor and insignificant. Sources of emissions from disposal of cannery waste are:

1) Odors generated during the loading/unloading of wastes;
2) Vessel emissions from the transport of wastes to the dumping site.
3) Potential emissions from the volatilization of components in the waste stream.

At present, approximately 48,000 gallons of cannery wastes are disposed of on a daily basis, although the average daily volume would increase to about 120,000 gal with the full scale disposal of press and pre-cooker waters. However, the same amount of solids and oil and grease would be discharged, lowering the concentrations. The capacity of the disposal vessel is now 24,000 gallons, and 2 vessel trips per day are now necessary to dispose of the cannery wastes. However, the vessel can be enlarged if necessary.

The disposal vessel which dumps cannery waste also generates air emissions. The dump vessel is a 1100 horse-power (hp) diesel vessel. Emission estimates have been derived from the EPA (1977) Compilation of Air Pollutant Emission Factors (AP-42), and estimated emissions prepared by the Port of Long Beach (PLB, 1975). The transportation emissions associated with the disposal of the cannery wastes are summarized in Table

Table III.5.a. ASG and Ambient Air Quality Standards

Air Pollutant	(Primary) Standard	Averaging Period
Ozone	0.12 ppm	1 hour
Carbon Monoxide	9 ppm	8 hours
	35 ppm	1 hour
Nitrogen Dioxide	0.05 ppm	annual
Sulfur Dioxide	0.03 ppm	annual
	0.14 ppm	24 hour
Total Suspended	75 ug/m^3	annual
	260 ug/m^3	24 hour
Lead	1.5 ug/m^3	calendar quarter

III.5.b.

For comparison purposes only, the project emissions have been compared with threshold levels for new source review in Regulation XIII of the South Coast Air Quality Management District (SCAQMD) in southern California. These thresholds are the levels which trigger offset requirements in the South Coast Air Basin and are among the more strict threshold levels in the United States. Note that the estimated emissions in Pago Pago are well below the SCAQMD threshold levels for "significant impacts". **An Air Quality Inventory of Tutuila has been performed and is on file with EPA Region 9. A study of odor from the canneries in 1988 confirmed the emission of hydrogen sulfide (S. Weigman, pers. comm.). However, land based emissions are beyond the scope of the FEIS.**

Finally, there is a potential for air emissions from volatilization of certain contaminants in the waste stream as they are discharged into the ocean. **These include hydrogen sulfide and ammonia-N due to the biodegradation of sludge.** Currently it is not possible to estimate these emissions. However, the portion of the waste stream that is subject to evaporative losses is expected to be very low because the waste is fish by-products which have been treated by dissolved air flotation (DAF).

Based on these conservative estimates, the potential for air quality impacts is believed to be negligible. The proposed ocean dumping activities will not result in the generation of significant amounts of air pollutants. Meteorological conditions provide excellent dispersion of pollutants, i.e., constant easterly wind flows. Therefore, this project does not impact the ambient air quality standards in the area and compliance with these standards is expected to continue.

III.B.1.d. Mitigations

Table III.5.b. Estimated Vessel Emissions*

	Pounds/day				
	ROG	SOx	TSP	NOx	CO
1. Within Harbor	0.07	18.14	2.28	4.13	0.04
2. To ocean dumpsite	0.37	36.15	12.88	8.54	1.60
TOTAL EMISSIONS	0.44	54.29	15.16	12.66	1.64
SCAQMD Threshold	75	150	150	100	550

* Assumes 2 trips/day; 40 to 60 gal per hour fuel consumption; 6 nautical miles to/from ocean dumping site at full speed; 3 miles at cruising speed within harbor and during discharge; and emission factors as given in EPA AP-42 Table 3.2.3-3 and 3.2.3-2.

The proposed ocean dumping of cannery wastes is a mitigation for odor impacts since the preferred location of the site is about 2.25 n mi offshore and well away from receptor areas. The loading of wastes does not create objectionable odors. No other mitigation measures are required due to the low level of air emissions generated by the proposed project.

III.B.2. PHYSICAL OCEANOGRAPHY

III.B.2.a. South Pacific Currents

American Samoa lies within the northern portion of the counterclockwise South Pacific gyre formed from the Pacific South Equatorial Current. The current south of 6° South, and between 100° West and 175° West, is variable and only a small portion of currents have rates between 1 and 2 k; most, but not all of the surface currents are in a westerly direction. The predominance of westward flowing currents decreases with increasing latitude, with a corresponding increase in variability [U.S. Defense Mapping Agency (USDMA), 1985; USNWS, 1979]. The South Equatorial Current begins as a wide band originating in the Peru Current off South America (Sverdrup et al., 1942), and becomes more narrow and with lower velocity as it moves westward when it reaches the archipelagos of the Line Islands, Tuamotu Islands and Society Islands (Figure III.6.). The extensive shoaling associated with the high volcanic islands and low atolls deflects and slows the water movement, also creating extensive eddy systems. Island effects are known to occur in the Pacific where currents are deflected and reflected off islands, depending on the angle of incidence with which the currents, winds and waves impinge on the island mass (USDMA, 1985).

Muromtsev (1963) identified the presence of a gyre beginning with the South Equatorial Current and flowing southwesterly and counterclockwise to the east of the Tuamotus and also a smaller gyre flowing southwesterly in the vicinity of American Samoa, and south along the Tonga Trench. Wyrtki (1975) and Blackburn (1981) indicated a gyre, originating in an eastward equatorial current at about 10° S and forming a counterclockwise gyre at about 170° E, which may occur in certain months

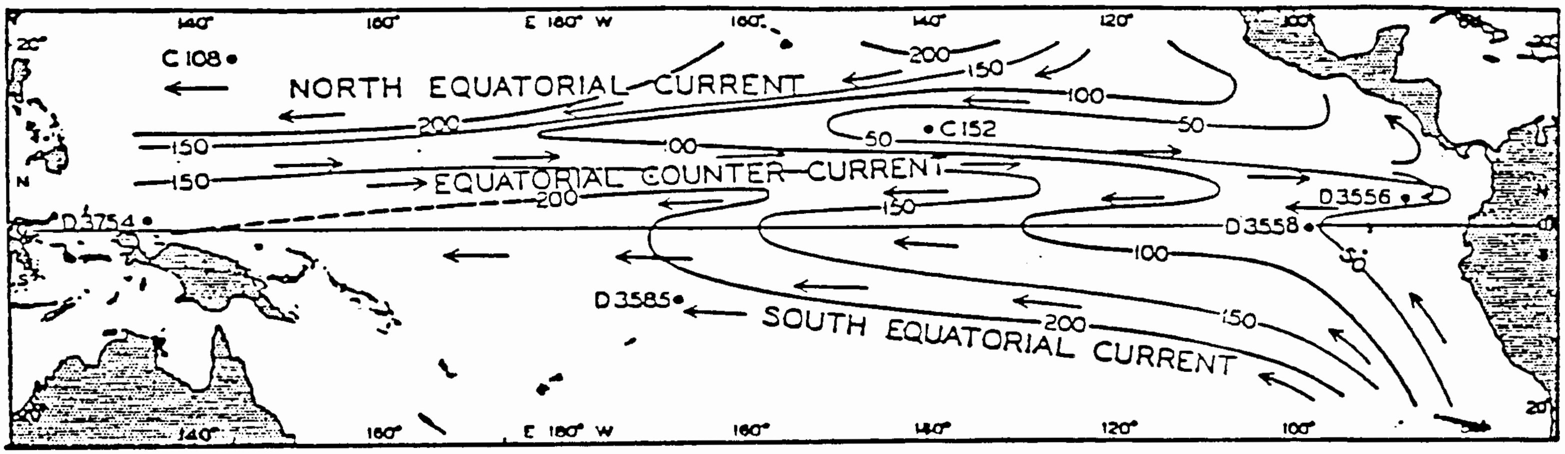


Figure III.6. Location of major currents (after Sverdrup et al., 1942). The center of American Samoa is located at 170°40'W by 14°17'S (see circle).

and would bring westerly waters into the Samoan Islands. According to Muromtsev, these gyres exist in the surface to 150 m depths, below which the southwesterly flow is obscured. Somewhat deeper water flows (below 200 m) are to the northwest from the Southern Ocean, which brings subantarctic waters north to converge with equatorial waters, creating midocean upwelling. At 2,000 m, Muromtsev showed a southward flow from the Gulf of Alaska to the Southern (Antarctic) Ocean, but at 2,500 m, he reported a northward flow from the Southern Ocean to the north equatorial area. Since depths south of American Samoa reach at least 2,750 m, the currents discussed above will all affect the biological conditions of the dumpsite area. The depth of the thermocline, to 150 m indicates that little mixing occurs between the upper waters and deeper waters in the vicinity of Tutuila. Flow from the south is unimpeded by any land mass before reaching Tutuila indicating the presence of a surface gyre.

III.B.2.b. <u>Currents off American Samoa</u>

Surface current velocities within the area of American Samoa are listed as being between 0.3 and 0.9 k, (USDMA, 1985; USMWS, 1979) and the generally prevailing direction of flow is towards the west southwest. The width of the island shelf, coupled with the prevailing winds and currents from the east south east, probably produce strong island effects such as an eddy at the southwest end of the island. This also tends to concentrate nutrients and fisheries resources there.

The very steep cliffs on the north shore, and along the south shore, particularly between the airport and Steps Point, are battered by waves that climb 30 to 40 ft up the cliffs, producing extreme turbulence at times. When winds shift to the north during storms, the southern nearshore waters are protected by the mountains, but gaps between peaks create window effects, again causing turbulent mixing. Currents always increase in narrow passageways such as the openings in reefs and do not always turn with the tides. Where a barrier reef lies close to the coast, a heavy swell will throw so much water over the reef that the escape of water causes a constant outgoing current, (USDMA, 1985). This is probably true of the Taema Bank area, as shown in drogue studies of Pago Pago Harbor, discussed below. Heavy rainfall that drains into the harbor would also add to outgoing flow.

Currents with velocities in excess of 1.0 k occur infrequently off Tutuila Island. The wind driven prevailing surface oceanic currents that impinge on Tutuila Island would cause wave reflection, localized eddy formation and variability in current direction and velocity. These could be further influenced by tides, even though the local tidal range is relatively small, with a mean range of 2.5 ft (0.76 m) and a spring tide range of 3.1 ft (0.94 m) (NOAA, 1986). Such variations would be more apparent close to shore and extend seaward an unknown distance.

The prevailing winds and oceanic current, plus the other shoaling or land phenomena, help to set up a persistent longshore current to the southwest along the coast between the west side of Pago Pago Harbor and Steps Point, although the surface current is known to reverse at times. These longshore currents keep waters from the present dumpsite offshore. In any case, contents of the waste field would not be measurable that far from the dumpsite since dilution factors and diffusion are so great. **Waters from the preferred dumpsite would not reach the longshore current.**

III.B.2.c. Previous Current Meter and Drogue Studies

Metcalf and Eddy Inc. (1979) evaluated nearshore currents with current meter measurements and drogues near the western boundary of Vai

Cove, at the western end of the airport runway. Their studies, conducted in February and July 1979 within about 0.5 n mi of shore, showed that there was a longshore current of 5.5 cm/sec (0.1 k) to 20 cm/sec (0.4 k) which they said was subject to tidal influence. Their data do not support the assumption that waters off Tafuna flow southwesterly during flood tide and northerly during ebb tide in February. Current directions were reversed in July, suggesting a seasonal shift in inshore tidal vectors, but data were insufficient to verify that. Surface drogues showed the effect of wind direction and velocity on the surface of the water column, with drogues traveling north northeast during ebb tide with light WSW winds, and toward the southwest during flood tide with strong north winds or light southeast winds. The data indicated a net transport of 5.5 cm/sec (0.1 k) in a southwest direction, with significant shoreward movement in Vai Cove under trade wind conditions. Vai Cove lies downcurrent of the shallow Tafuna Sewage Treatment Plant outfall.

Measurements of currents were few and brief off American Samoa. Dames and Moore Inc. (1974) observed flow to enter Pago Pago Harbor on the east side and move counterclockwise to exit on the west side, which fits with field data from Taema Bank, discussed below. CH_2M Hill Inc. (1976) measured the longshore current with drogues in October 1975 as traveling southwest at 0.25 to 0.3 k between the 120 fm and the 600 fm contours (Figure III.7.). They stated that net transport at the area on the south side of Taema Bank was probably due south, and the current was south-westerly, under trade wind conditions (Figure III.8). The sites being studied by them were for outfall locations in about 10 m of water. CH_2M Hill (2984) confirmed the outward flow on the west side from Pago Pago Harbor, regardless of tide.

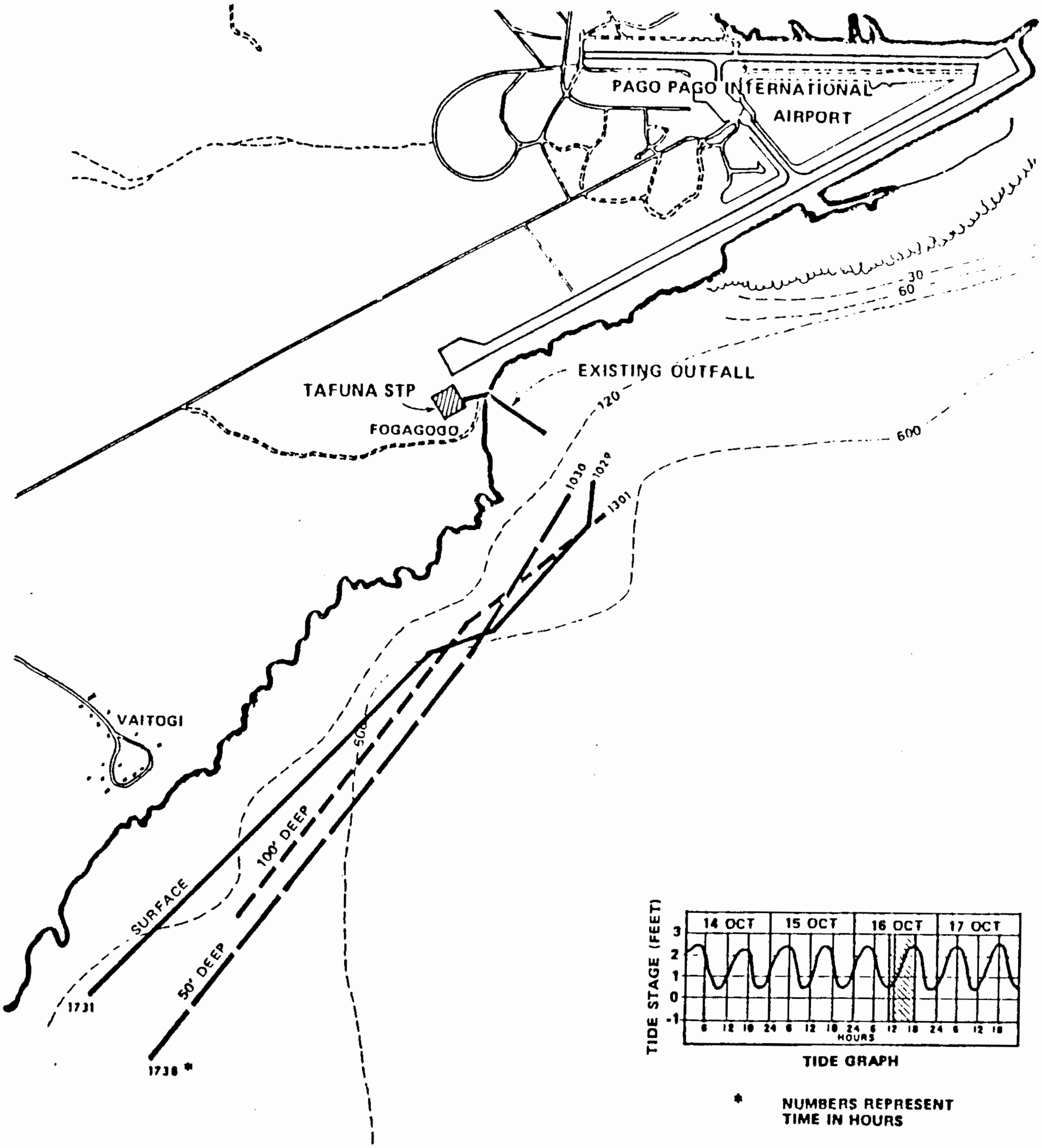


Figure III.7. Drogue study October 17, 1975 of Tafuna outfall site (from Ch2M Hill, 1976). Drogues in the longshore current between the 120 fm (222.4 m) and 600 fm (11.8 m) contours had speeds of 0.25 k (12.5 cm/sec) at the surface and 50 m, and 0.30 kn (15 cm/sec) at 100 m.

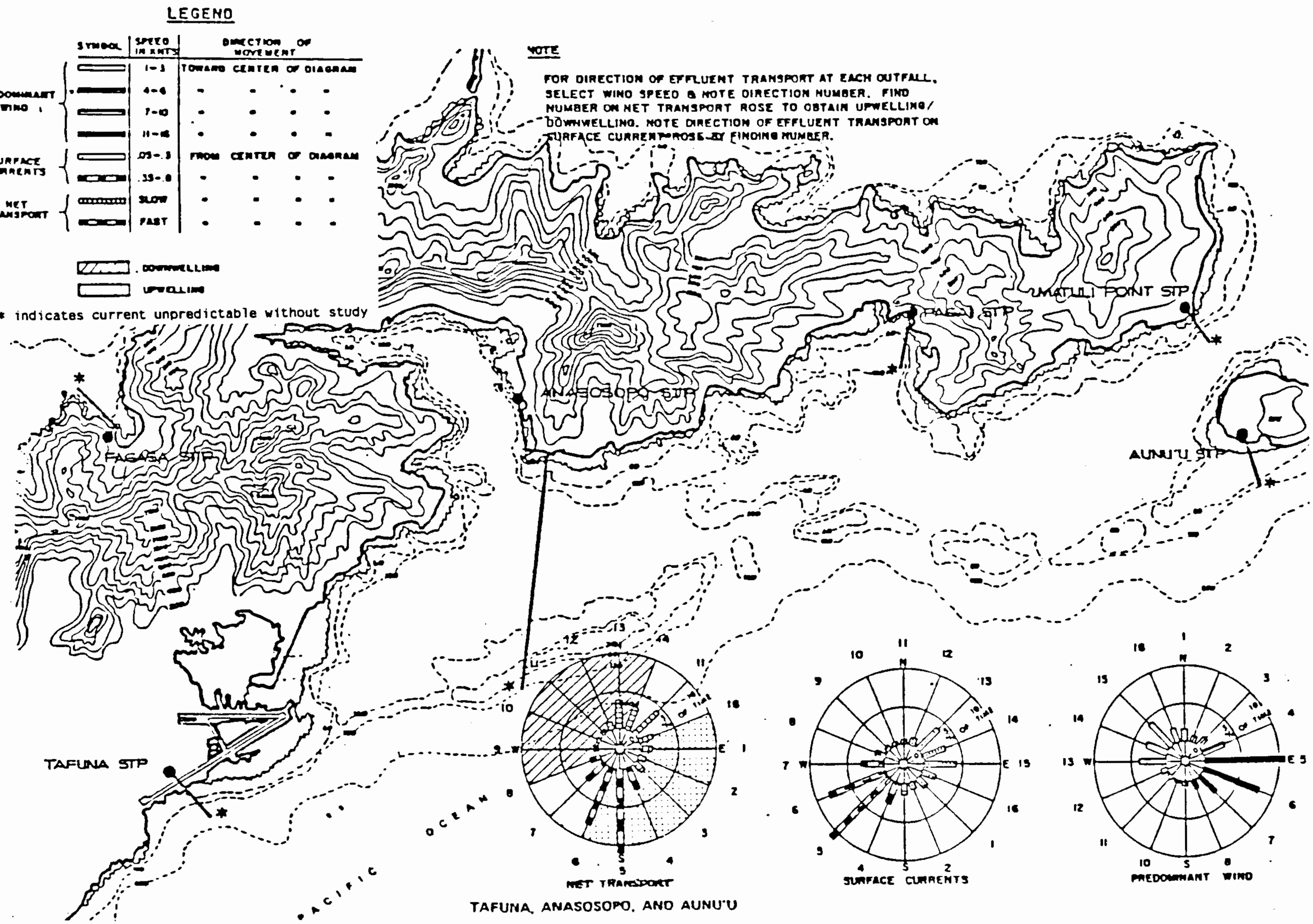


Figure III.8. Probable net transport surface currents and predominant wind off Tutuila (after CH2M Hill, 1976).

Soule and Oguri (1983a, 1984) conducted studies further at sea, in the general vicinity of the presently located dumpsite and seaward of the Tafuan area that Metcalf and Eddy studies in 1979. Drogues were used to follow dispersion of cannery waste fields generated by ocean dumping of wastes similar to those being studied in the current permit application. Current measurements were conducted in January and July 1982 and in March 1983, centered on the site for ocean dumping under EPA permit No. OD 79-01/02 located at **170°41.00' W, 14°22.00'** S, about 2.25 n mi southeast of Matautuotafuna Point, slightly west of the present site at 170°40.87' W, 14°22.18'S. Surface drifters ("frisbees" with plastic streamers attached) and drogues were released at the surface, 10 m and 30 m, both at the dumpsite during dumping operations and at a control site to the southwest.

Drogues and drifters were also released further inshore on two occasions to assess the seaward extent of the longshore current effects and to evaluate the position of the dumpsite relative to the possibility of wastes reaching the shore. The swells that break over Taema Bank at low tide or at Breakers Point at high tide apparently funnel the mass of water that accumulates out of the harbor entry area on the west side of the bank. This helps to establish the longshore current that flows toward the southwest from the harbor and parallel to the shore along the airport, and the cliffs, moving out to sea off Steps Point. Wave reflection off the cliffs would also reinforce the longshore current when winds are from the east.

In January 1982, currents moved in different directions on three separate days, as shown by the tracks of the drogues and drifters (plastic frisbees with streamers attached). This illustrates the variability of the waters, depending on wind and weather as well as larger scale oceanographic features.

On January 18, little or no movement was detected, and on the 20th the plume moved southwest. On the 21st, both the plume and the drogue tracks split, initially moving to the northeast and, with increasing northeast wind, most of the drogues shifted to a more pronounced southeast direction. Drogues at the south control site (CS) 1.8 n mi southwest of the dumpsite, released on the 20th, moved southwest (Figure III.9), apparently influenced by the long shore current. Drogues released on the two other field days at the south control site were not found subsequent to release, but waters appeared to be running strongly to the south off Steps Point.

Drogues released in July 1982 drifted in a northerly direction, to the north on the 20th and northeast on the 23rd (Figures III.10.,11). Velocities noted were all under 0.5 k (25 cm/sec), with the surface drogues outsailing the deeper ones; all drogues tended to move faster than the visible waste field.

On March 24, 1983, the waste field was tracked over time, using water quality measurements and visual observations to locate the leading and trailing edge. The leading edge moved west southwest (Figure III.12), generally parallel to the coastline presumably in the longshore current, at 0.68 k (35.07 cm/sec), and the trailing edge traveled southwest at 0.66 k (33.70 cm/sec). Winds were gusting to 7 k and there was a 4-6 ft long swell out of the southeast. Low tide was at 0930, -0.1 ft.

On March 25, drogues were deployed at the surface, 10 m and 20 m depths at the dumpsite. Drogues were also released shoreward of Taema Bank about 1 n mi south of Pago Pago Harbor to determine the direction of flow there. Surface drogues released at the dumpsite moved west southwest

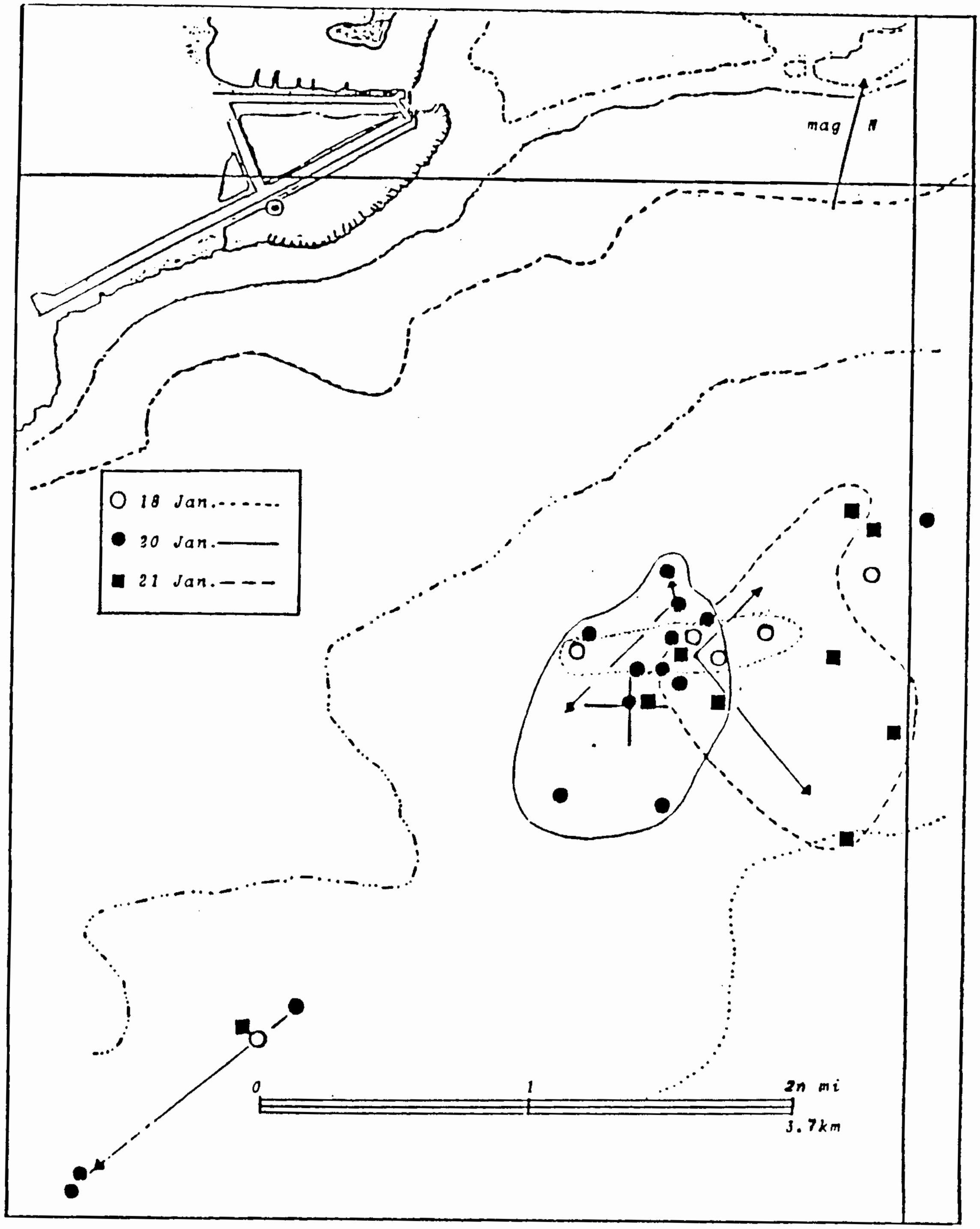


Figure III.9. Movement of waste plumes tracked by drogues, American Samoa, 1982. Note that direction is mostly southwest on January 20, to northeast and southeast on January 21 (from Soule and Oguri, 1983).

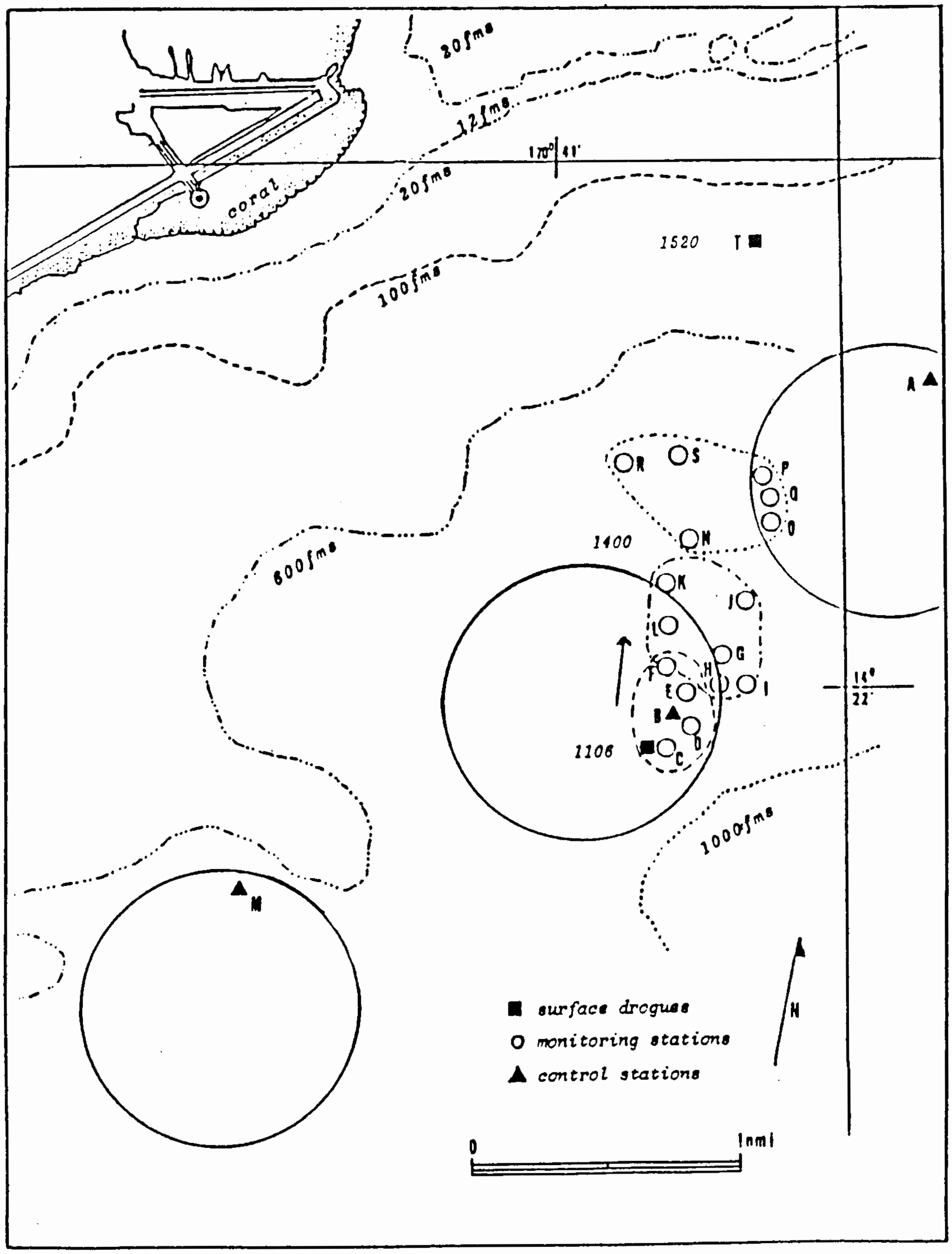


Figure III.10. Waste plume (dotted circles), monitoring stations and drogue movements, July 20, 1982. drogue T was not near plume after 4 hrs. (wind was from the south, 10-16 k; low tide at 1255, -05 ft) (from Soule and Oguri, 1983).

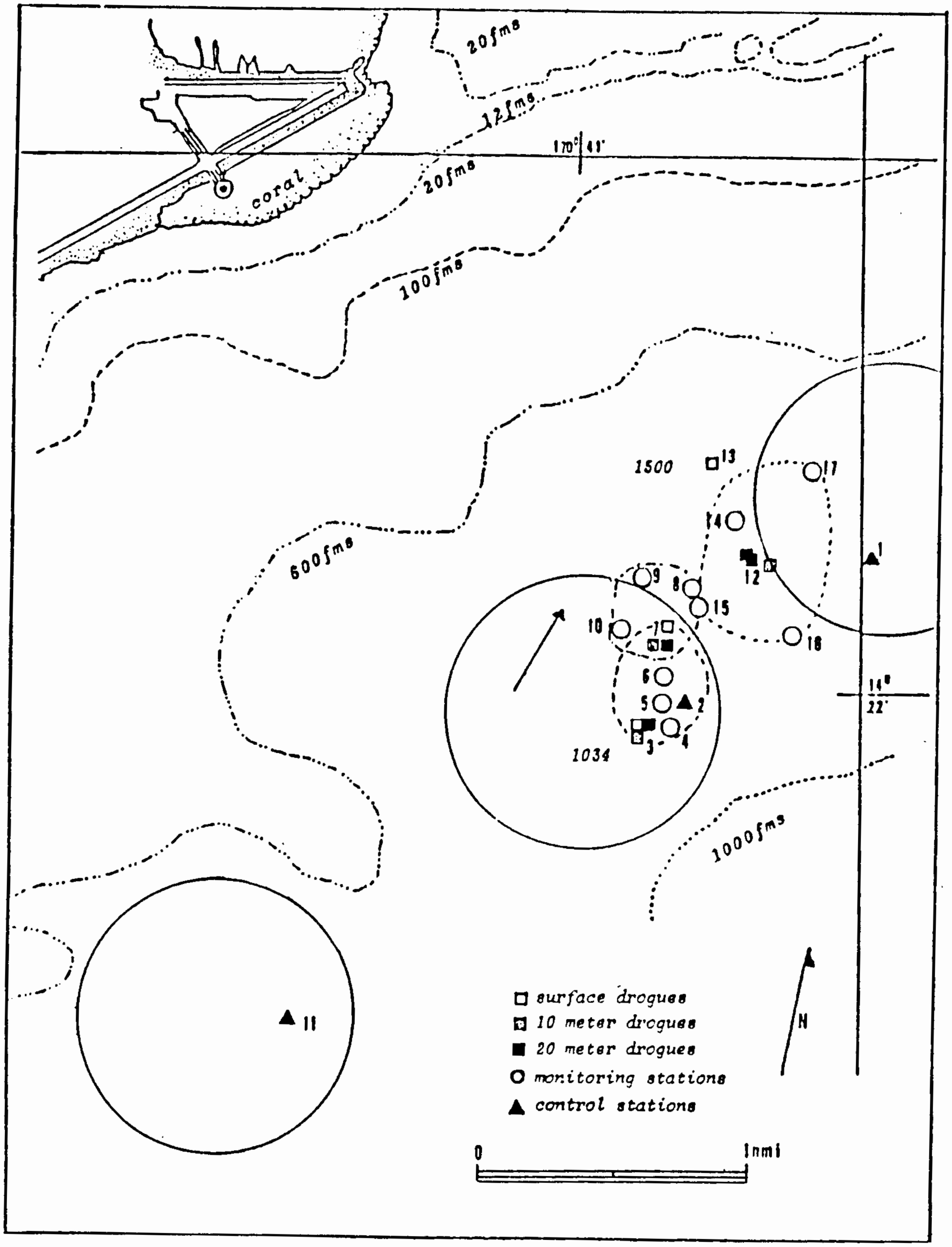


Figure III.11. Waste plume (dotted circles), monitoring Stations and drogue movements, July 23, 1982. (south wind, 0.6 k; low tide at 1530, -0.5 ft) (from Soule and Oguri, 1983).

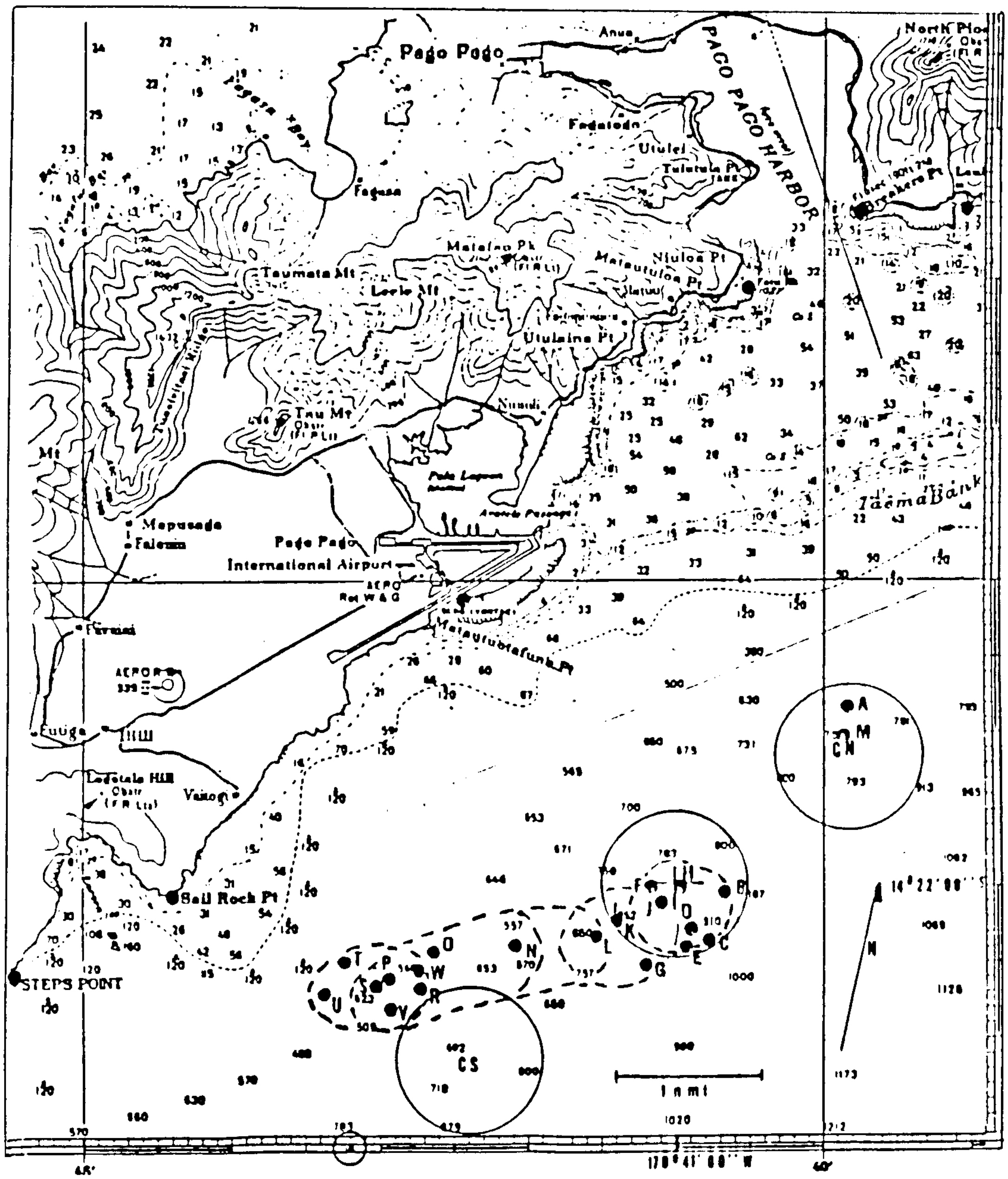


Figure III.12. Movement of waste plume on March 24, 1983. CN = control north, CS = control south, dumpsite is center circle. Depths in fms. (from Soule and Oguri, 1984).

at 0.94 k (48.4 cm/sec), 10 m drogues moves at 0.69 k (35.5 cm/sec), and the 20 m drogues moved at 0.63 knots (32.4 cm/sec). These velocities are higher than those observed during the previous studies (Figure III.13). Drogues released inshore at Taema Bank the same depths moved at roughly half the velocities in the same general direction, although they first traveled northwest toward the harbor. They then moved in a westerly direction which was against the tidal flow (Soule and Oguri, 1984). Ultimately the surface inshore drogue went ashore off the eastern end of the airport and the 20 m drogue went aground about 1 n mi westward of the grounding position of the surface drogue. The 10 m drogue moved slightly offshore at a position near the 20 m drogue and was still drifting when the observations were terminated.

On March 28, drogues were released at all three depths at the dumpsite and three ten meter drogues were released across Taema Bank, with the most shoreward one being deployed inside the Bank, the next released just over the seaward edge and the last deployed about 0.4 n mi seaward of the second drogue. Drogues released at the dumpsite moved westward initially (Figure III.14) turning southwest subsequently at speeds of 0.39 k (20 cm/sec) at the surface, 0.22 k (11.3 cm/sec) at 10 m and 0.24 (12 cm/sec) at 30 m, about one third to one half of the velocities observed on the 25th. The inshore drogues moved at rates of about 0.15 k (7.7 cm/sec) in a generally westward direction, with the two most inshore drogues trending to the north and directly into shore. The seaward drogue trended slightly south of due west, suggesting that Taema Bank may be a critical barrier differentiating the longshore drift.

In summary, the direction of drogues was primarily west to southwest during January and March, the southern hemisphere summer, and north to

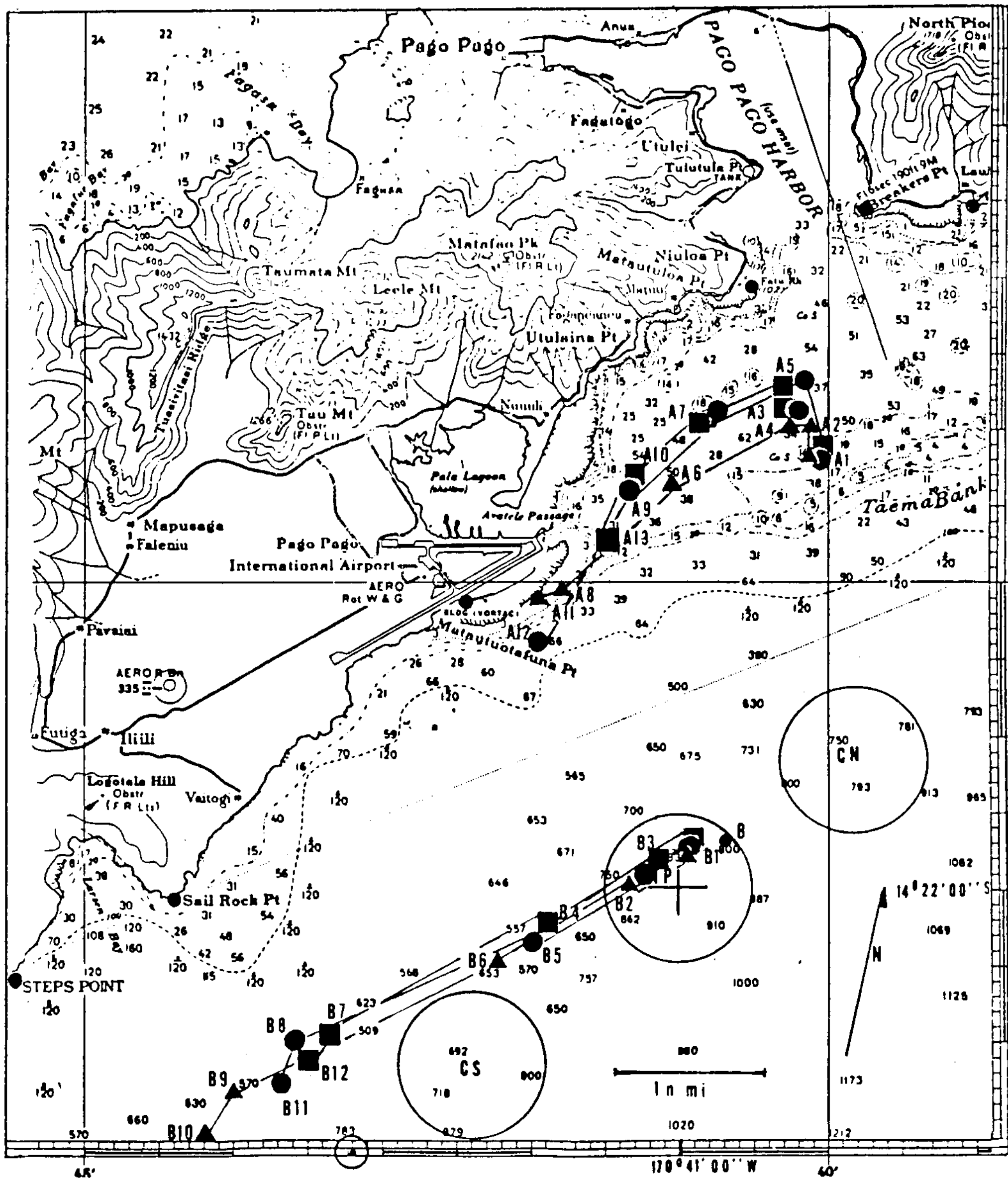


Figure III.13. Drogue trajectories and speeds at Taema Bank (A series) and dumpsite (B series) March 25, 1983. surface drogue A, 0.40 k (20.7 cm/sec): 10 m drogue A, 0.42 k (21.8 cm/sec): 20 m drogue A, 0.20 k (14.9 cm/sec): surface drogue B, 0.94 k (48.4 cm/sec): 10 m drogue B, 0.69 k (35.5 cm/sec): 20 m drogue B, 0.63 k (32.4 cm/sec) (from Soule and Oguri, 1984).

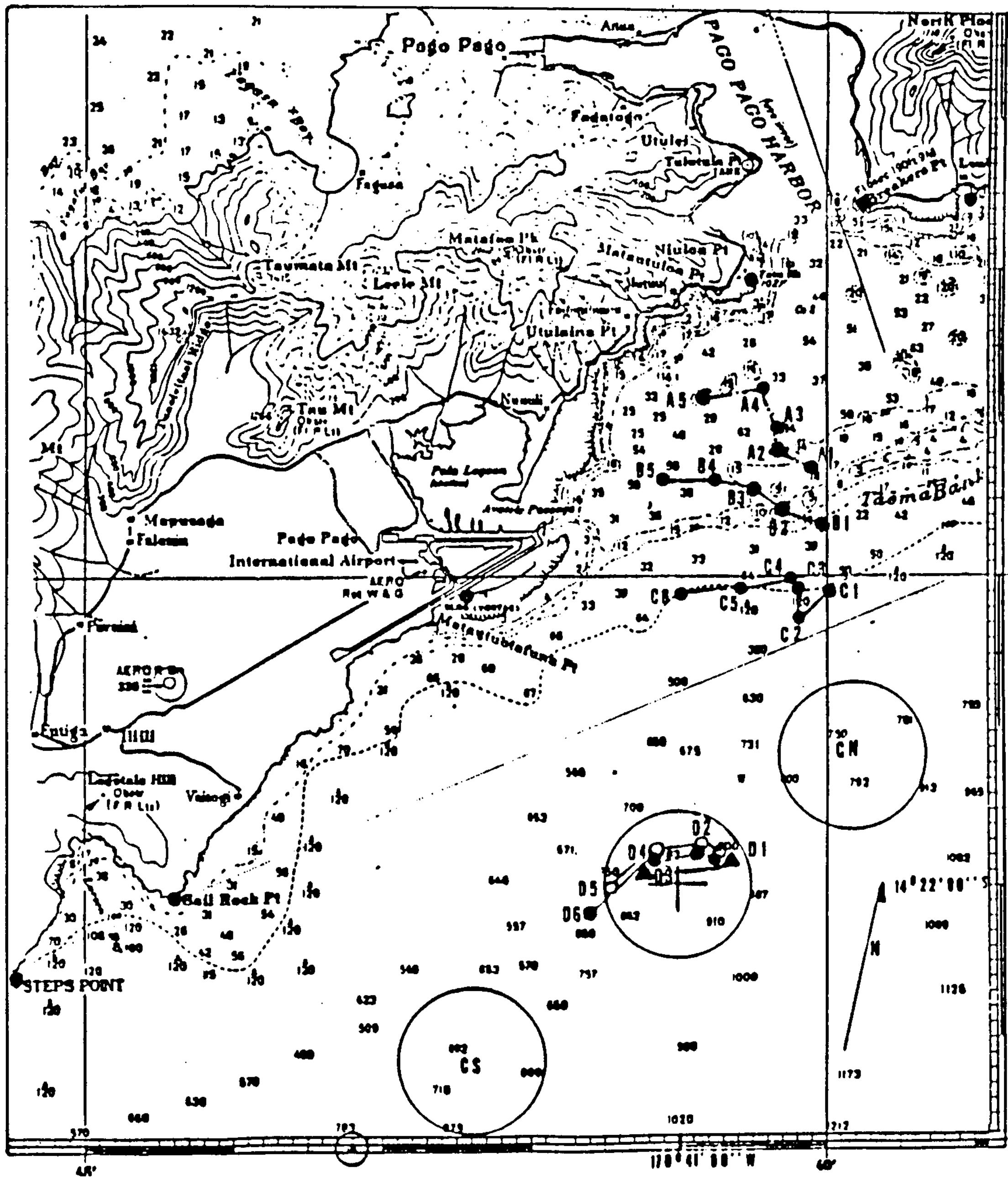


Figure III.14. Ten meter drogue trajectories and average speeds at Taema Bank (A,B,C), and dumpsite (D) on March 28, 1983. A drogues inside bank, 0.14 k (7.2) cm/sec): B drogues over bank, 0.15 k (7.7 cm/sec): C drogues outside bank, 0.17 k (8.9 cm/sec): surface drogues 0.39 k (20 cm/sec): 10 m D drogues, 0.22 k (11.3 cm/sec): 30 m D drogues, 0.24 k (12 cm/sec) (from Soule and Oguri, 1984).

northeast during July, suggesting a seasonal shift. It should be noted that drogues consistently outsailed the waste field. Furthermore, the waste field would have dispersed well before the waters that carried it reach shore, according to observations and calculations (See Appendix B).

III.B.2.d. Recent Monitoring

More recent data on the currents in the general area of the dumpsite been reported to EPA Region 9, submitted in partial fulfillment of the requirements for monitoring under Ocean Dumping Permit OD 86-01/02 (SOS Environmental, Inc., 1987 a-f, 1987j). This included obtaining current meter profiles to 20 m and the tracking of drogues released at a depth of 3m in the wake of the discharging dump vessel for 4 hours.

Drogues drifted in a northerly direction, varying from north northwest on April 29 and June 16, 1987, to north on June 3 and July 30, to north northeast on August 25 (Figures III.15-19). Rates of drift reported varied from 0.13 k (6.7 cm/sec) to 0.30 k (15.4 cm/sec) for the first four months but jumped to 0.87 k (44.7 cm/sec) in August. The average rate of drogue drift for the first 4 months was 0.185 k (9.5 cm/sec); by including the fifth month, the overall average rate of drift increased to 0.322 k (16.6 cm/sec). Drogue studies were discontinued in September 1987.

At the average of 0.32 k, drogues would theoretically reach shore in about seven hours unless deflected by the longshore current. However, field sampling was unable to detect the wastes after 4 hours. Since the drogues generally outsailed the waste field, the waste field would have long since dissipated, as well as having been affected by the local long-shore current and kept away from the shore. The numerical model study (Appendix B) gives estimates of the time needed for dispersion before the

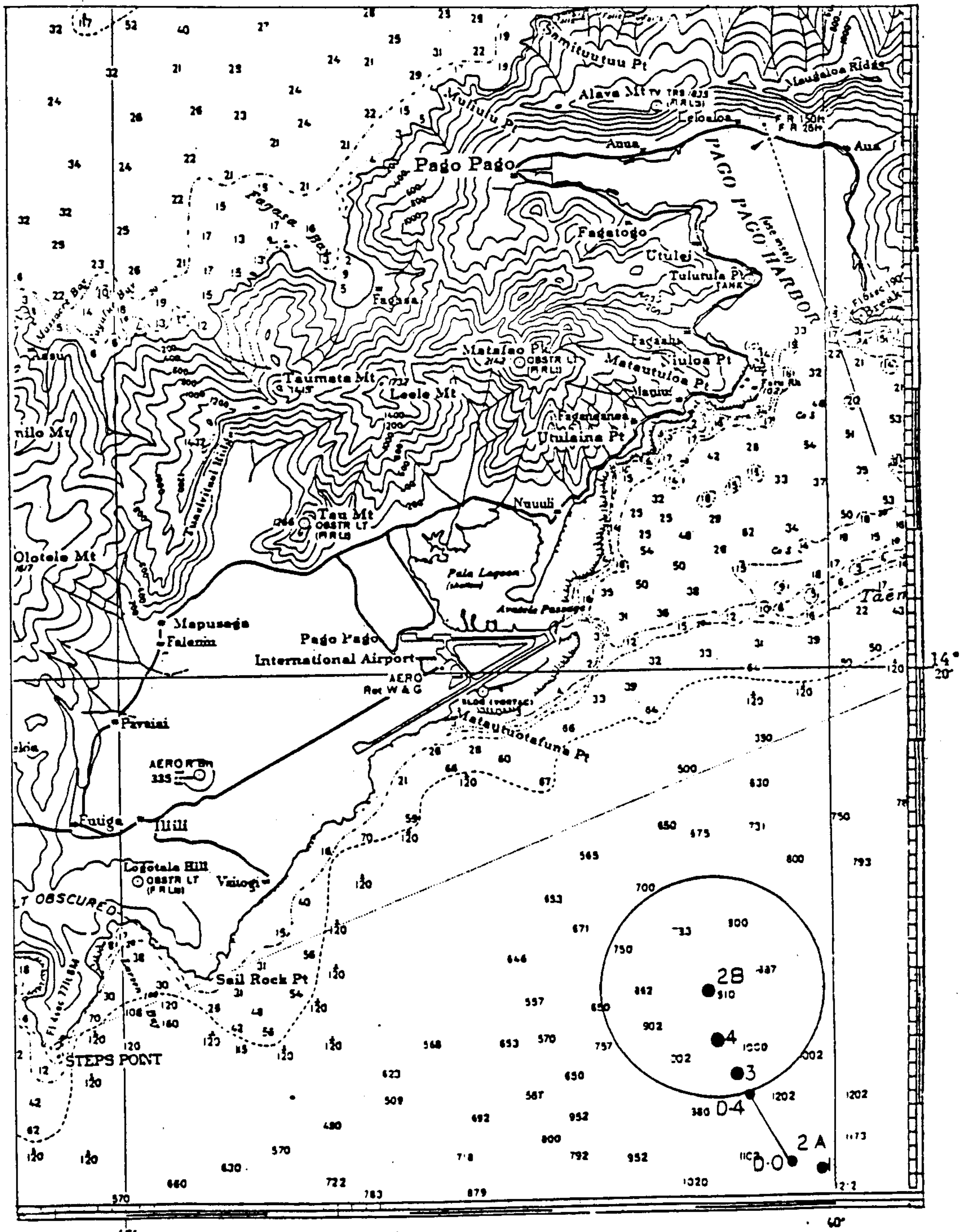


Figure III.15. Monitoring stations, April 29, 1987. Station 1, 1.5 n mi upcurrent of station 2 B: 2 A, after start of dumping: 2 B, center of dumpsite before dumping: 3, 0.75 n mi downcurrent from station 2 A: 4, 1.0 n mi downcurrent from station 2 A: D-O, drogue deployment site: D-4, drogue position after 4 hrs (from SOS-Environmental, Inc., 1987a).

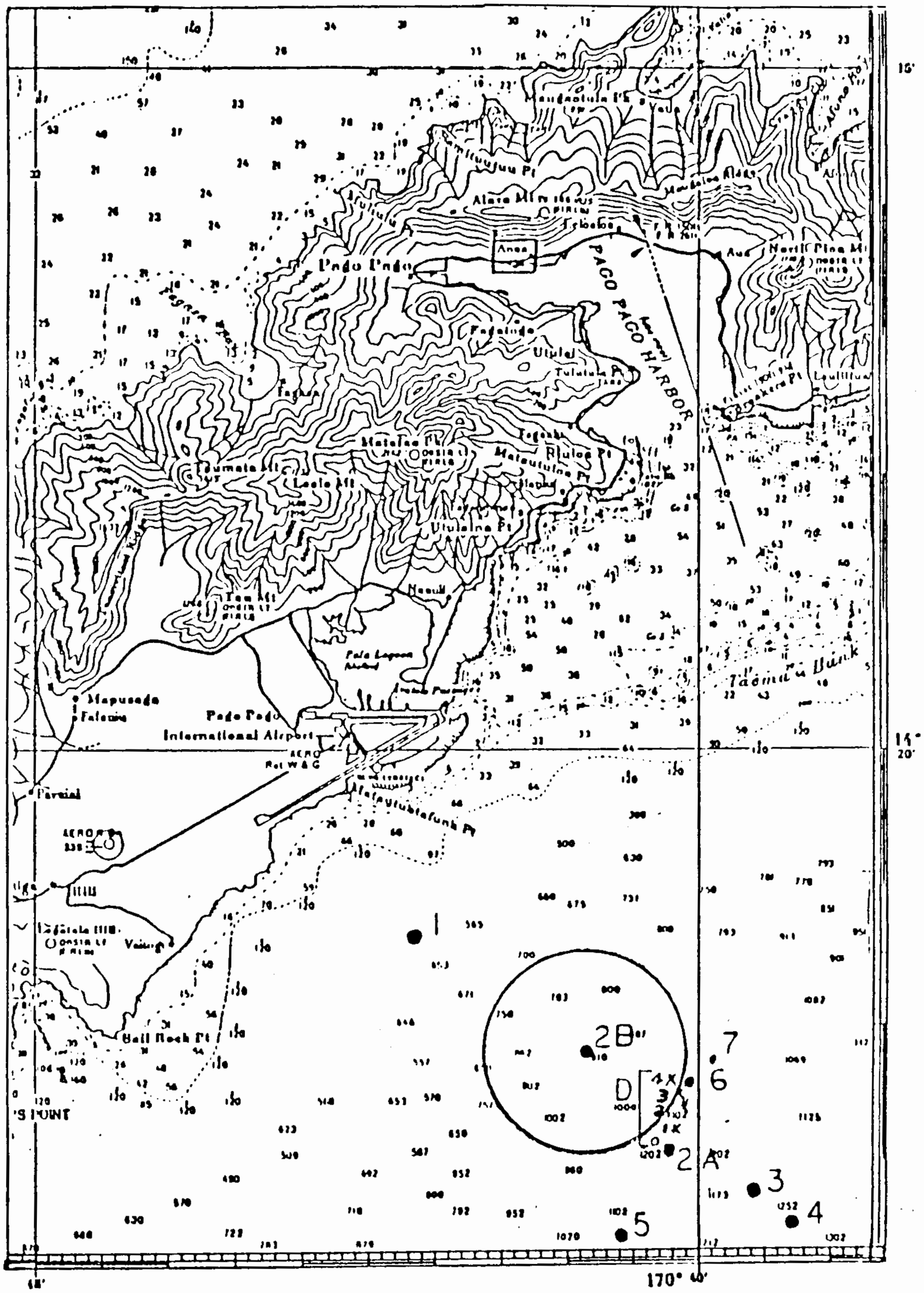


Figure III.16. Monitoring Stations, June 3, 1987. Station 1, 1.5 n mi Upcurrent of Dumpsite Center: 2 A, after Start of Dumping: 2 B, Center of Dumpsite before Dumping: 3, 0.75 n mi Downcurrent from Station 2 A: 4, 1.0 n mi Downcurrent from Station 2 A: 5, 0.75 n mi from Station 2 A and 90 Degrees to Current: 6, 0.75 n mi Upcurrent from Station 2A: 7, 0.75 n mi from Station 2 A and 270 Degrees to Current: D-0, Drogue Deployment Site: D-1, Drogue Position after 1 hr: D-2, Drogue Position after 2 hrs: D-3, Drogue Position after 3 hrs: D-4, Drogue Position after 4 hrs (SOS- Environmental, Inc., 1987b).

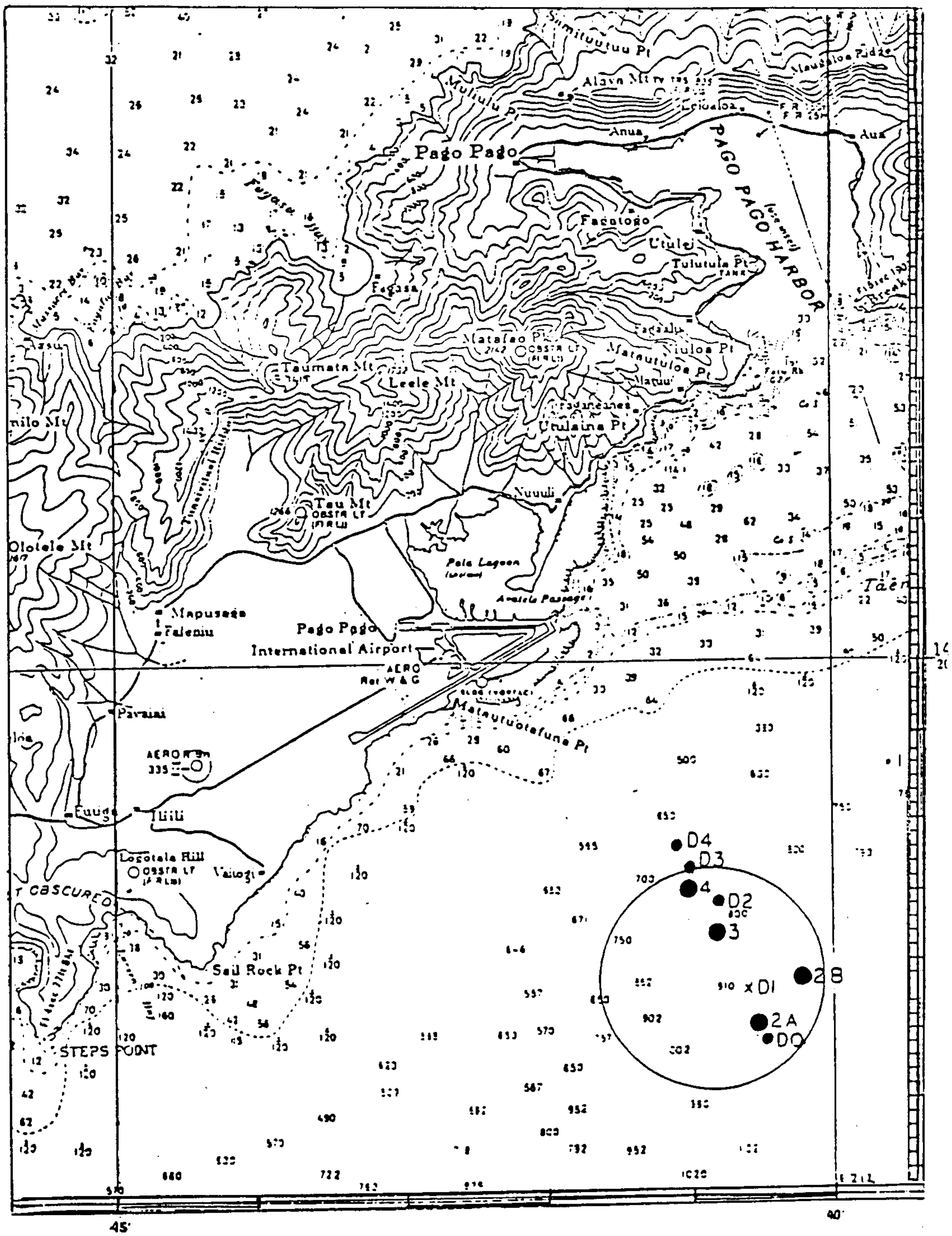


Figure III.17. Monitoring stations, June 16, 1987. Station 1, 1.5 n mi upcurrent of station 2 B: 2 A, after start of dumping: 2 B, center of dumpsite before dumping: 3, 0.75 n mi downcurrent from station 2 A: 4, 1.0 n mi downcurrent from station 2 A: D-0, drogue deployment site: D-1, drogue position after 2 hr: D-2, drogue position after 2 hrs. D-3, drogue position after 3 hrs: D-4, drogue position after 4 hrs (from SOS-Environmental, Inc., 1987c).

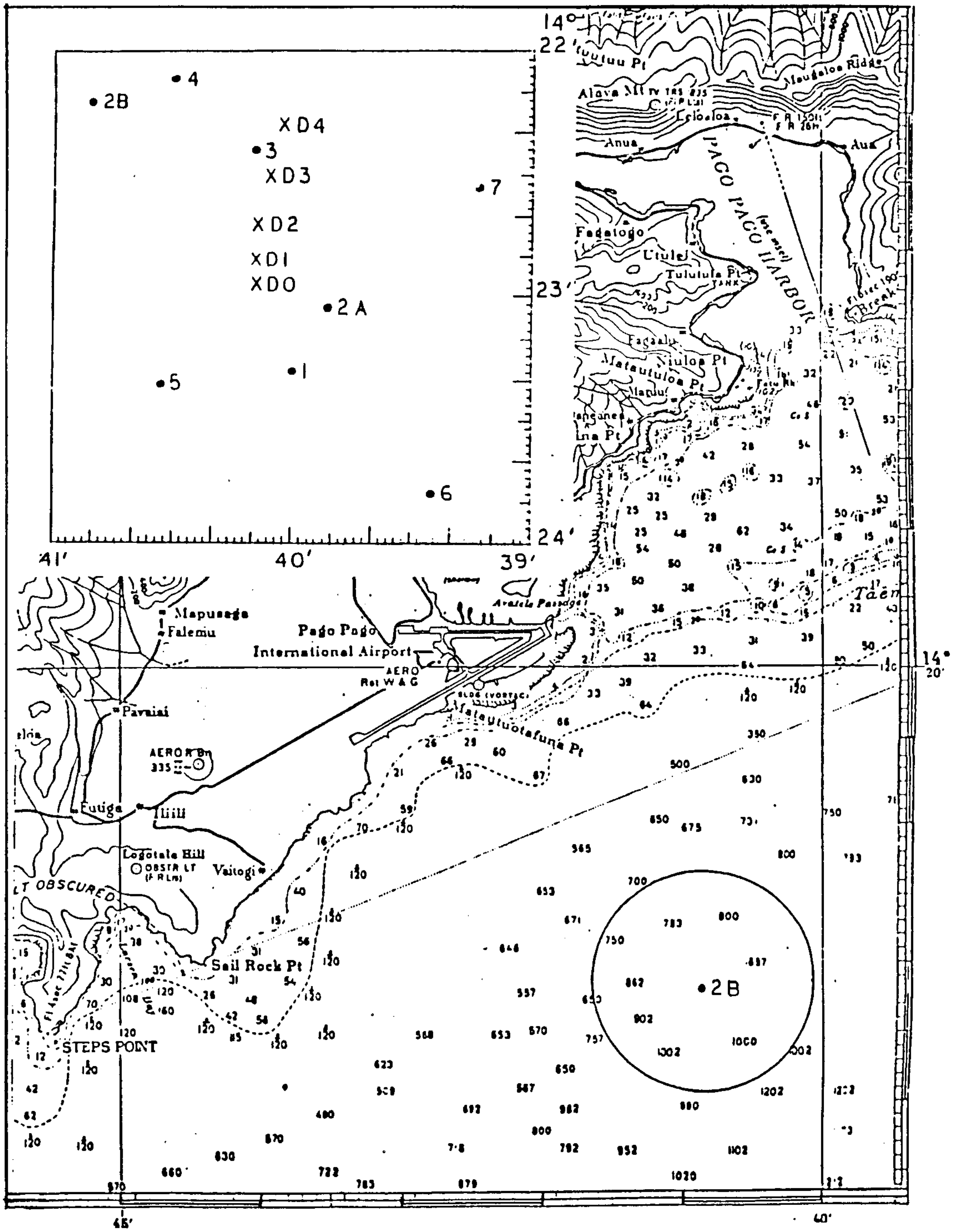


Figure III.18. Monitoring stations, July 30, 1987. Station 1, 1.5 n mi upcurrent of station 2 B: 2 A, after start of dumping: 2 B, center of dumpsite before dumping: 3, 0.75 n mi downcurrent from station 2 A: 4, 1.0 n mi downcurrent from station 2 A D-0, drogue deployment site: D-1, drogue position after 1 hr D-2, drogue position after 2 hrs; D-3, drogue position after 3 hrs: D-4, drogue position after 4 hrs (from SOS-Environmental Inc., 1987d).

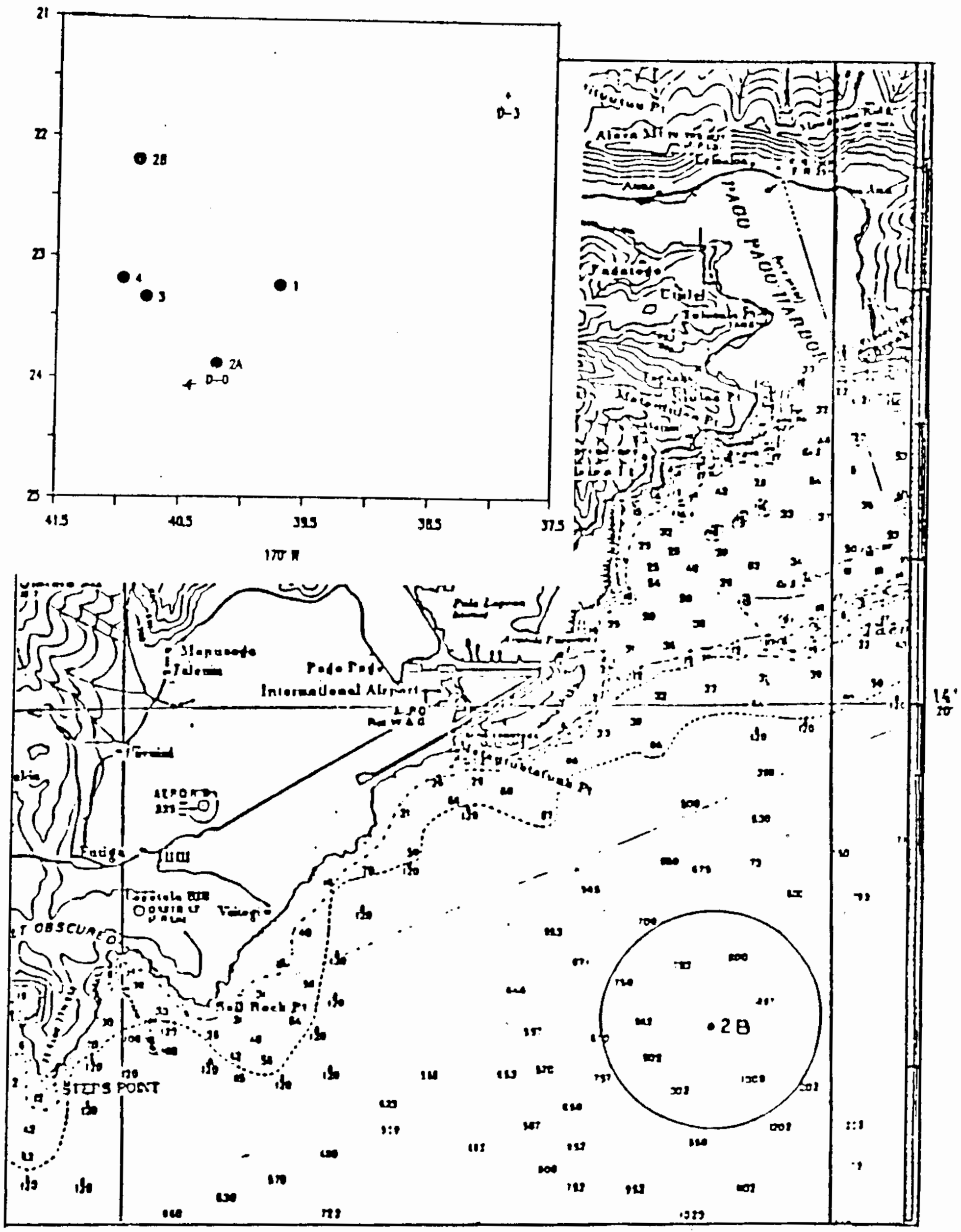


Figure III.19. Monitoring stations, August 25, 1987. Station 1, 1.5 n mi upcurrent of station 2 B: 2 A, after start of dumping: 2 B, center of dumpsite before dumping: 3, 0.75 n mi downcurrent from station 2 A: 4, 1.0 n mi downcurrent from station 2 A: D-0, drogue deployment site: D-4, drogue position after 3 hrs (from SOS-Environmental, Inc., 1987e).

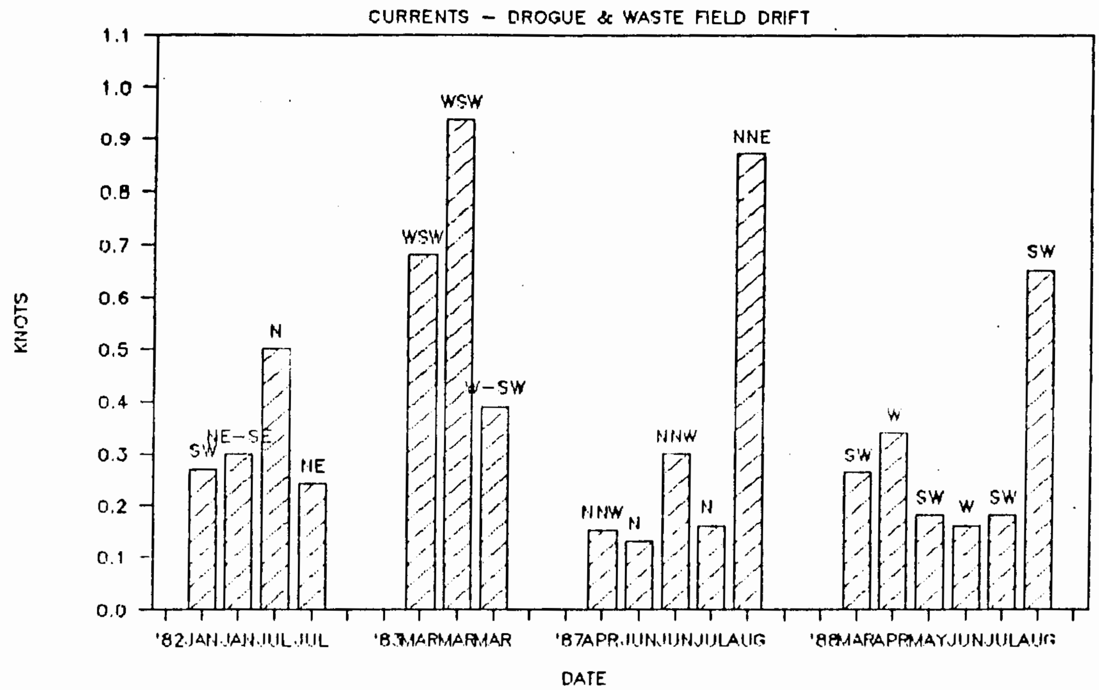
water that contained the waste would reach shore.

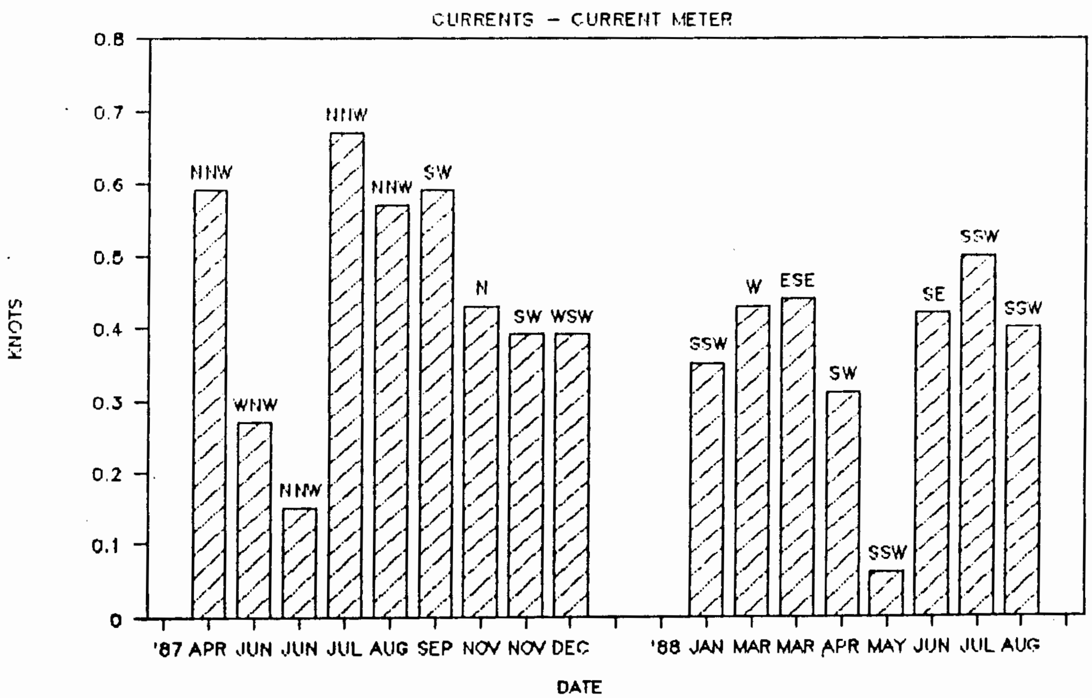
Current profiles to 20 m based on measurements with an InterOcean Model S4 current meter deployed from a boat were taken at two stations in the dumpsite area during each cruise. The indicated currents differed in velocity and vector from the drogue drift data, generally indicating a faster current, usually offset to the west from the drogue drift direction. Current meter velocities ranged from 0.16 k (8.2 cm/sec) to 0.67 k (34.4 cm/sec). Currents were also from the southeast, varying from 139^{o} to 155^{o} in origin. A steady wind stress acting together with the Coriolis (earth rotation) force will produce transport to the left of the wind. Wind-driven transport is strongly surface trapped, 95% occurring in the upper 25 m where the thermocline is shallow, or to the depth of the thermocline.

Current velocities were related to wind speed. With winds of 10 to 14 k during some cruises, current speeds averaged 0.61 k, whereas with winds of 3 to 4 k, currents averaged 0.22 k. Winds during the first five monitoring cruises were from the southeast. The general agreement in direction between wind and current meter data suggests that the higher current meter readings, as compared to drogue drift data, may be due to wind drift of the boat deploying the current meter. Since the plume moved more slowly than the drogues, the current meter readings are less definitive. Current velocities and directions are shown as measured by drogues or the wastefield movement (Figure III.20.a) and by current meter (Figure III.20.b).

III.B.2.e. Seasonality and El Niño Effects

Some reversal of offshore current direction, possibly seasonally, but perhaps storm related, was noted in 1982-1983. Drogues generally





Figures III.20a.b.

a. Direction and Speed of Currents Determined by Drogues in 1982, 1983 and 1987. (Drogue studies were discontinued in 1988.

b. Direction and Speed of Currents Determined by Current Meter in 1987-88.

Note seasonal shift in direction to the west-southwest in most September-March (summer) data and to the northerly directions between April-August (winter).

moved west and southwest in January and March, the southern hemisphere summer, and to the north northwest in July, in the winter. This shift was also observed in 1987 monthly monitoring but not in 1988. With two exceptions, current directions were to the west and southwest from September 1987 through March 1988, and to the north, northwest and northeast from April through August 1987. From April 1988 through August 1988 monthly current meter readings were to the southwest, south southwest, or southeast, while the plume moved to the west or southwest.

It should be noted that the 1982-1983 studies all took place during the very strong El Niño - Southern Oscillation (ENSO) event. During that period, the trade winds virtually disappeared and current direction reversed in the South Equatorial Current, with flows carrying warm tropical waters eastward to the coast of South America. When zonal wind anomalies occur in the western equatorial Pacific, equatorial east winds weaken or westerly winds occur. This is accompanied by formation of downwelling (Kelvin) waves which travel eastward, crossing the Pacific in about two months. They set up an eastward current anomaly and these effects in turn combined to raise sea surface temperatures across the equator to South America (Shiying and Jinshu 1987). This affected wind and current directions (e.g., January 1982 fluctuations) as well as water temperatures recorded in American Samoa during the 1982 studies (e.g., Soule and Oguri, 1983a, 1984; Harrison and Cane, 1984; Rasmusson, 1984; Toole, 1984. No trade winds were encountered and water temperatures were warmer than average during the 1982-1983 Soule and Oguri field efforts. Rainfall was much lower, but the drought was not as extreme as that in Australia, for example. A more transitory El Niño occurred in 1986, with easterly winds and warmer waters in the central Pacific (Kerr, 1987). Seeming inconsistencies between data sets from the various field efforts might be explained, in part, by ENSO events.

III.B.2.f. Waves

The ocean surface in the American Samoa area is usually dominated by a broad sweep of prevailing easterly trade winds. Waves are predominantly from the easterly sectors, with some trending towards the north during the southern hemisphere summer (USNWS, 1979). Although a broad spectrum of wave heights may be encountered, the vast majority do not exceed 3 m, with the most frequently occurring monthly average lying in a range extending up to 2.5 m in height. Waves within this range and beyond tend to be higher in the winter when wave heights of up to 5 m are not uncommon, and isolated reports of waves of over 10 m occur.

Waves in the present dumpsite area are of similar height and show evidence of refraction. However, this tendency is not persistent or strong in the dumpsite vicinity. Wave refraction from the cliffs west of the airport probably contributes to the longshore current and the trend to the southwest observed at times offshore from Steps Point. During the El Niño period high winds and waves were observed from the south (Soule and Oguri 1983a).

III.B.3. WATER COLUMN CHARACTERISTICS

III.B.3.a South Pacific Water Masses

The islands of American Samoa lie north of the interface of the Southern Tropical Surface Water (STSW) and the South Central Subtropical Surface Water (SCSTSW), according to Muromtsev (1963). The STSW usually extends from 2° north of the equator to 15 - 20° south, and the SCSTSW extends from 15 - 20° to 38° south. Changes in zonal wind and current circulation cause variation in the extent of the surface water masses. Underlying the two water masses, or water types as used by Muromtsev, at depths from 100-150 m to 500-600 m are the South Subtropical Subsurface Waters (SSTSW) which extend from 2-^{o} N to 40^{o} S and are formed by mixing of the two primary layers of water. Since the bottom depths are so great off the Samoan ridge, the dumpsite includes South Pacific Intermediate Waters (SPIW), from below the subsurface waters to depths of 100 - 1500 m, and Southern Upper Deep Waters (SUDW), from below SIW to 400 - 5000 m. The Intermediate waters form at the Antarctic Convergence, and extend from 15-18^{o} N to 60^{o} S. The characteristics of the various water masses will be exhibited at the extremes of their geographic ranges with the accompanying physical parameters, as shown in Table III.6.

III.B.3.b. <u>Surface Temperature</u>

The mean sea surface temperature in the tropical mid-Pacific is 28^{o}C (Figure III.21 after Toole, 1984). A 27^{o}C isotherm extends across the western tropical Pacific generally to the Tuamotus during the southern winter and sometimes to South America in the southern summer. The anomalous extension of a 29^{o}C isotherm to the eastern Pacific was characteristic of the 1982-83 ENSO event. The extensive documentation during and since the 1982-83 ENSO event may lead to revision of "normal" oceanographic means.

American Samoa is usually within the 27^{o}C isotherm area unless water masses shift northward. Average sea surface temperatures are consistently warmer than air temperatures by about half a degree, 28.2^{o}C (82.76^{o}F), compared to an average air temperature of 27.7^{o} (81.86^{o}F). There is only a minor seasonal change in temperature of less than 1^{o}C

Table III.6. Characteristics of Water Masses*

	STSW	SCSTSW	SSTSW	SPIW	SUDW
Geographical Extent	2° N - 15-20° S	15-20° S - 38° S	2-3° N - 40° S	15-18° N - 60° S	
Depth (m)	0-150	0-150 -	100-600 -	500-1500	1000-5000
Temp (°C)	26-29	20-25	10-20	3 - 6	2 - 2.5
Salinity (ppt)	35-35.5	35.5-36.45	34.8-36.3	34.1-34.5	34.6-34.66
Dissolved Oxygen (ml/L)	4.0-4.6	4.0-5.2	0.4-4.5	0.3-5.8	2.81-3.84
DO, Percent Saturation	80-100+	80-95	75-80	10-55	42-48

STSW = Southern Tropical Surface Water
SCSTSW = South Central Subtropical Surface Water
SSTSW = South Subtropical Subsurface Water
SPIW = South Pacific Intermediate Waters
SUDW = Southern Upper Deep Waters

* after Muromtsev (1963)

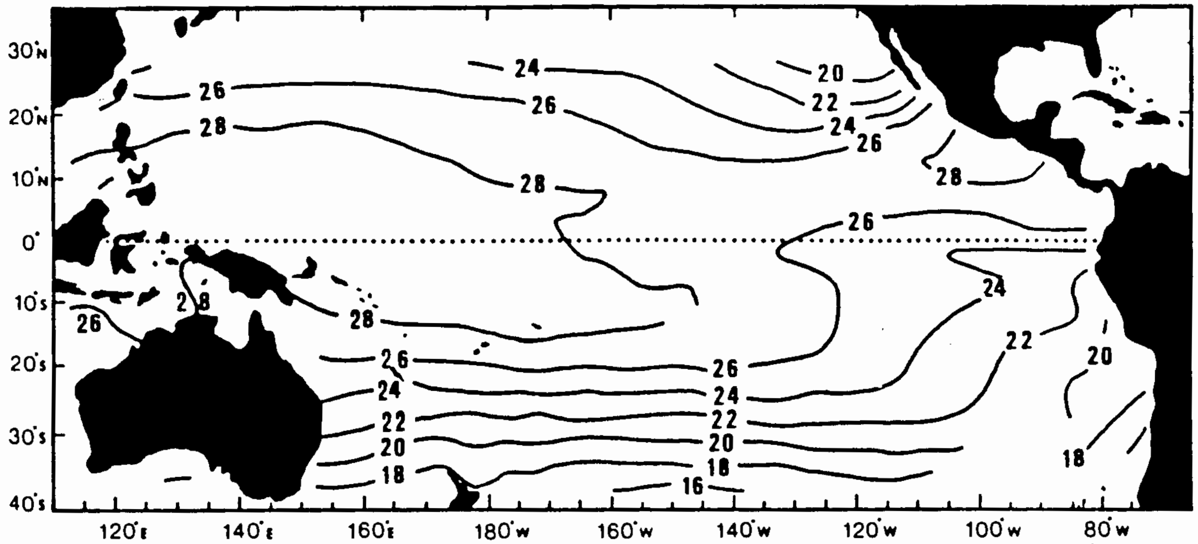


Figure III.21. Mean sea surface temperature in the tropical Pacific ocean. Note 28° isotherm extending eastward to about 145°W (after Toole, 1984).

($1.8^{\circ}F$) of the ocean surrounding American Samoa. Long term sea surface temperatures averaged $27.8^{\circ}C$ during the months of June through October and $28.5^{\circ}C$ during November through May (USNWS, 1979).

Surface temperatures in the area of the proposed dumpsite were taken in January, and July 1982, and in March 1983 (Soule and Oguri, 1983a, 1984). Those temperatures were warmer than the averages indicated above (USNWS, 1979), and may illustrate the effects of the strong ENSO event that occurred during that period, but the data still show seasonal patterns and differences. Surface temperatures were generally within the ranges and standard deviations observed for specific months as given in USNWS (1979).

More recent data from monthly cruises in the dumpsite area for the period of 29 April 1987 to 25 August 1987 were reported to EPA Region 9 (SOS-Environmental, 1987a-e). These indicate surface temperatures that were somewhat higher than the averages listed by USNWS (1979), but they still show the same seasonal pattern and relatively slight range of variation. Whether the values indicate further ENSO activity, or a series of warmer than normal years, or a difference in sampling technique or instrumentation is not known. A Martek instrument was used for all data gathered, and the remote probes were calibrated according to manufacturer's specifications. The field data are summarized in Table III.7.

III.B.3.c. <u>Water Column Temperature to 20 Meters</u>

Temperatures through the water column were measured by Soule and Oguri (1983a, 1984) in the vicinity of the designated dumpsite, to at least 20 m, in January and July 1982 and March 1983. Monthly measurements from the ongoing monitoring of the present dumpsite, under EPA ocean dumping permit OD 86-01/02, also reported temperatures extending to 20 m

Table III.7. Sea Surface Temperature Ranges During Monitoring in°C(°F)*

	1982	1983	1987
Jan	29.0 - 29.7 (84.2 - 85.5)		
Feb Mar		29.3 - 29.6 (84.7 - 85.3)	
May Jun			30.4 - 30.7 (86.7 - 87.3)
Jun			29.3 - 29.9 (84.7 - 85.8)
			29.3 - 30.8 (84.7 - 87.4)
Jul	28.2 - 28.7 (82.8 - 83.7)		27.9 - 28.5 (82.2 - 83.3)
Aug			27.9 - 29.1 (82.2 - 84.4)
Sept			28.0 - 28.0 (82.5 - 84.8)
Oct			---- ----
Nov			28.0 - 28.0 (82.5 - 82.5)
Dec			28.0 - 28.0 (82.5 - 82.5)

* Temperature was not required in 1988.

during monitoring during April though August 1987 (SOS, Environmental, Inc. 1987 a-e). Although the surface temperatures tended to be slightly higher than the deeper ones, there were few changes in temperature exceeding 1°C between depths sampled of up to 10 m or between stations on any given date in the water columns measured.

The lack of a detectable thermocline to those depths is not unexpected for the tropical sub-equatorial waters of the South Pacific. Long term prevailing winds over a broad sweep of ocean with lack of seasonal overturn results in a persistent, sharp thermocline at depths considerably deeper (150 to 200 m) than were sampled during these studies (Figure III.22). This, in turn, leads to the persistence of the clear, oligotrophic waters typical of tropical oceans such as those of the American Samoa oceanic area. The upper waters are wind driven and subject to turbulent mixing, whereas the waters below the thermocline are stable and not well mixed. A profile of temperature along 170°-180° W between the poles is graphed in (Figure III.23 after Muromtsev, 1986). American Samoa is at 14°17' South latitude.

III.B.3.d. <u>Salinity</u>

Oceanic salinity in 1982 and 1983 (Soule and Oguri, 1983, 1984) ranged from 34.1‰ to 37.1‰ (parts per 1000), but differences between samples never exceeded 1.5‰ on any day or generally 0.5‰ at any depth sampled at any station, including those in the highest concentration of cannery waste. Salinities during the 1987 monitoring surveys (SOS, Environmental, Inc., 1987 a-e) were somewhat lower than those found in 1982 - 1983, ranging from 31.2 ‰ to 32.6‰. Salinities observed during all of these studies showed no evidence of a halocline to depths of 20 m, further reinforcing the observed lack of any vertical discontinuity in

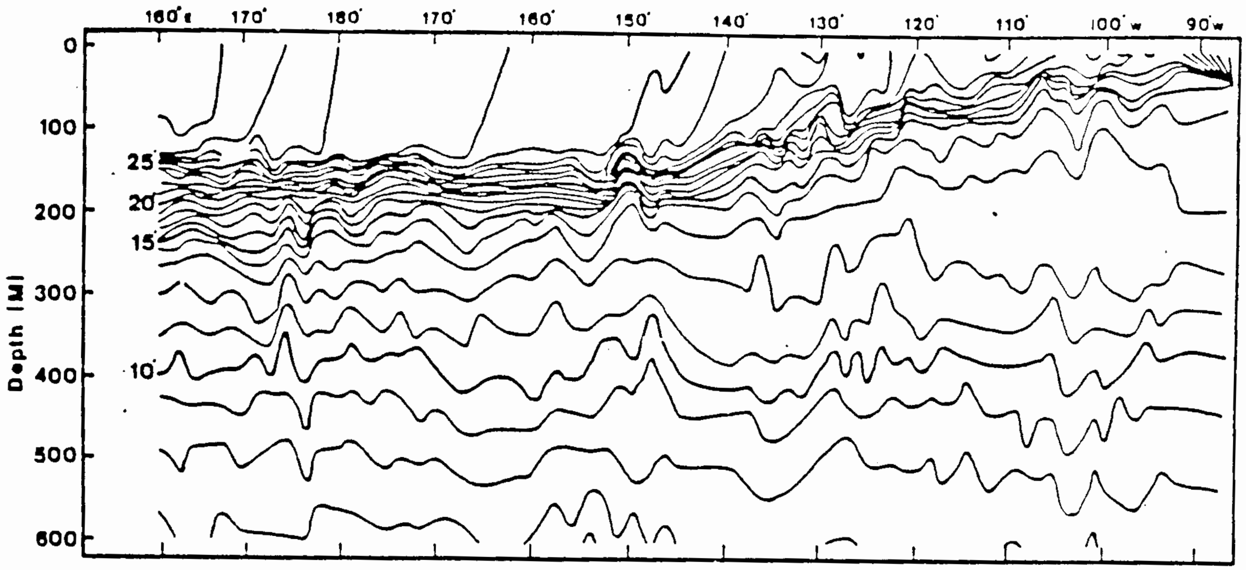


Figure III.22. Thermocline (converging lines) is between 100 and 200 m at 170°40'W (after various authors).

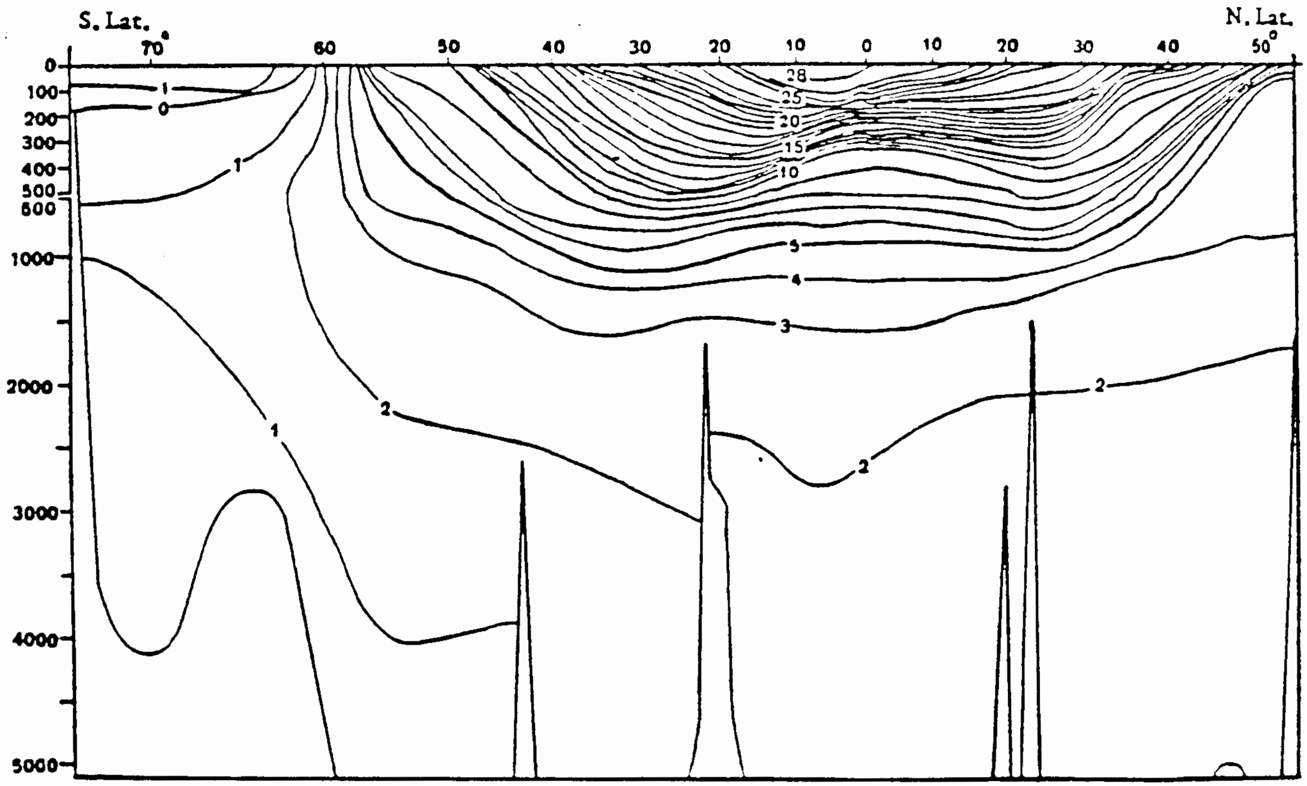


Figure III.23. Profile of temperature from south latitude to north latitude along 170°-180°W (after Muromtsev, 1963). American Samoa is 14°17' south latitude by 170°40' west longitude.

temperature that could lead to stratification of the water column to depths of 20 m. The higher salinities in 1982 - 1983 were consistent with the lower rainfall in American Samoa; heavy rainfall at the equator and east of 160° W produced lower salinities in that region (Donguy and Eldin, 1985). Heavy rains in American Samoa in 1987 may have resulted in lower salinities. A Martek instrument was used in both studies, although models were different. They were calibrated by the manufacturer or according to instructions. Salinities graphed in the tropical Pacific along 170°-180° show values suggesting that the higher salinities between 35°/oo and 36°/oo are more normal (Figure III.24, after Muromtsev 1964).

III.B.3.e. Other Parameters

The monitoring cruises conducted in 1982 and 1983 (Soule and Oguri, 1983a, 1984) and in 1987 (SOS-Environmental, 1987a-e) included a series of other measurements related to ambient water quality in areas free of waste and those being subjected to cannery waste sea disposal. These included routine water column measurements of dissolved oxygen and pH, and less regular laboratory analyses of other parameters such as BOD (Biochemical Oxygen Demand), ammonia-nitrogen, total phosphorus, total nitrogen, and total and volatile solids.

In general the only departure from fairly uniform station to station variation and water column distribution of the various parameters occurred in the surface samples taken in the immediate wake of the discharging waste dump vessel and these perturbations did not persist. Dissolved oxygen (DO), although variable, usually did not fall below 5 mg/l (ppm), even in the most dense part of the waste field. Higher than saturation values indicate the turbulent mixing induced by wind and wave action. Density (Figure III.25) and Dissolved Oxygen (Figure III.26) are graphed as

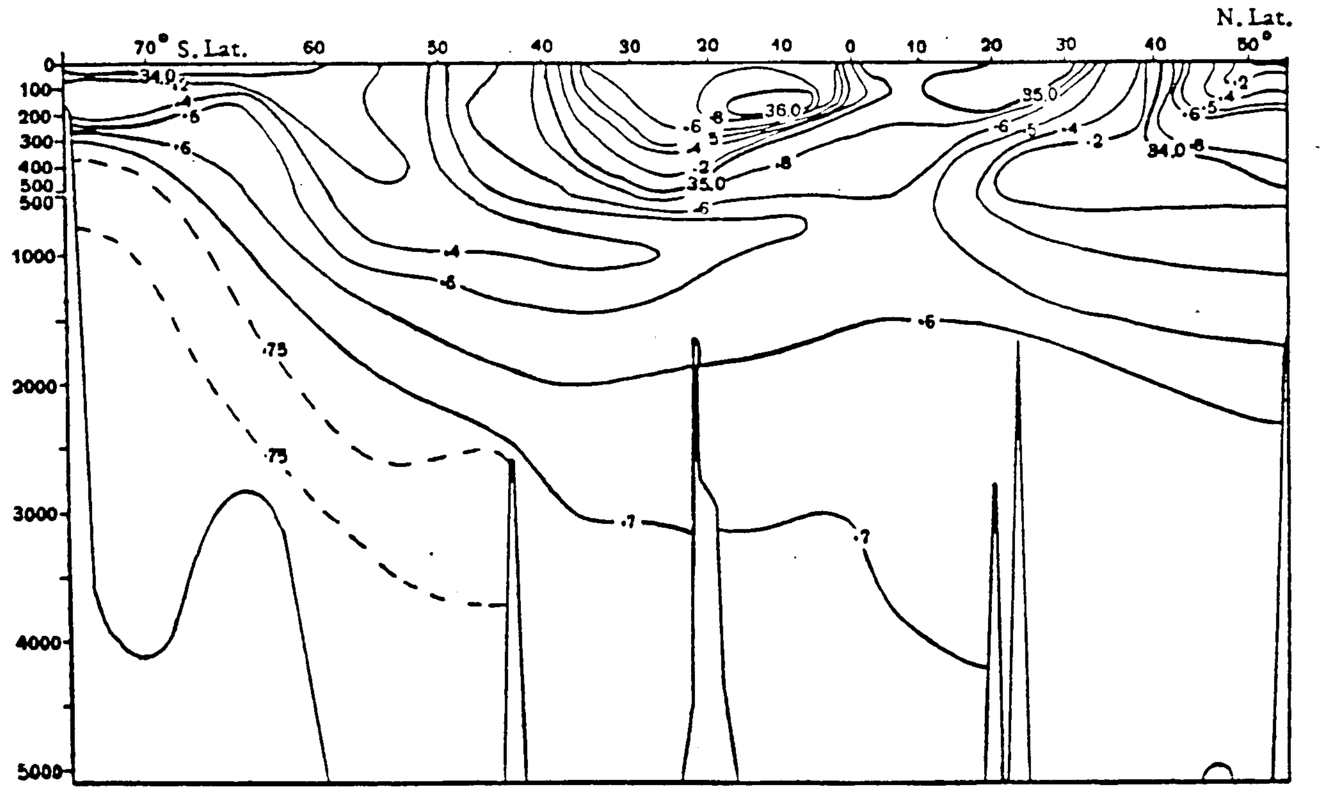


Figure III.24. Profile of salinity from south latitudes to north latitudes along 170°-180°W (after Muromtsev. 1963).

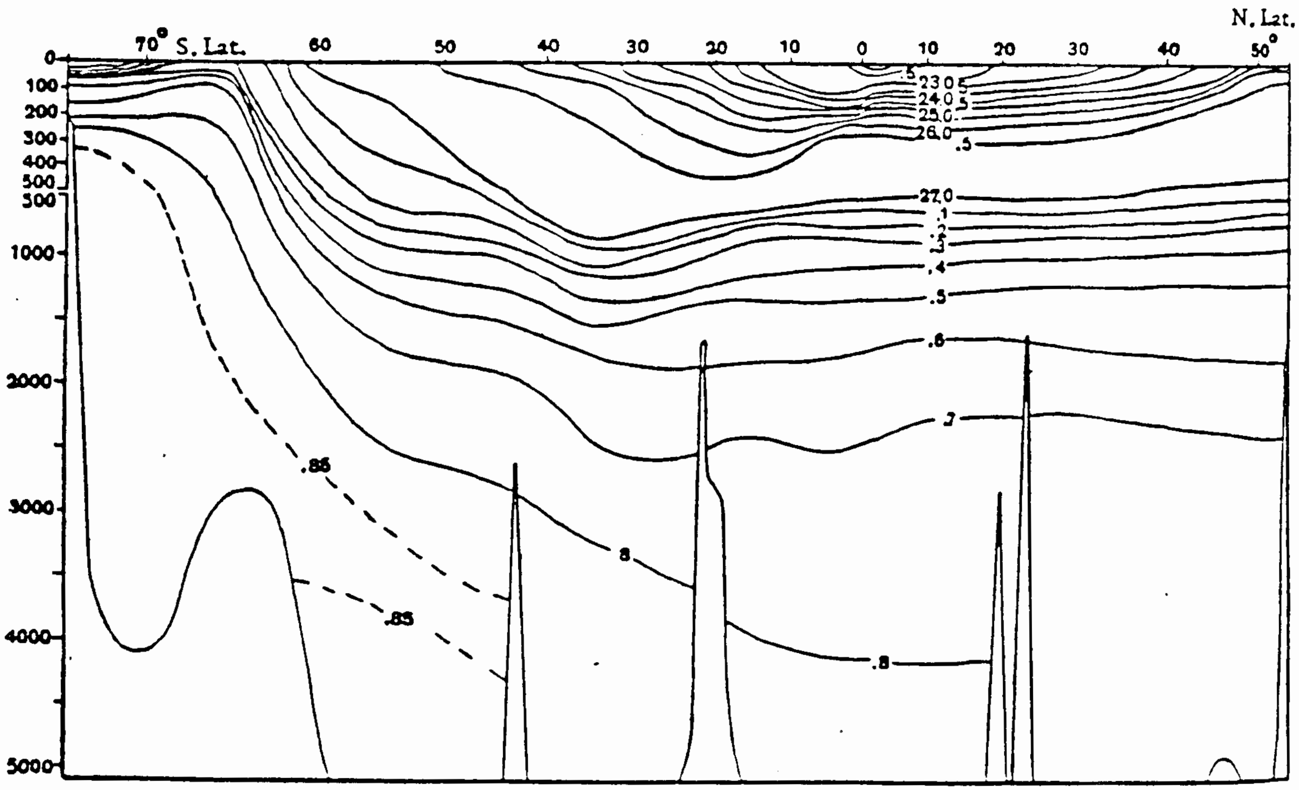


Figure III.25. Profile of density from south latitudes to north latitudes along 170°-180°W (after Muromtsev, 1963). American Samoa is 14°17' south latitude by 170°40' west longitude.

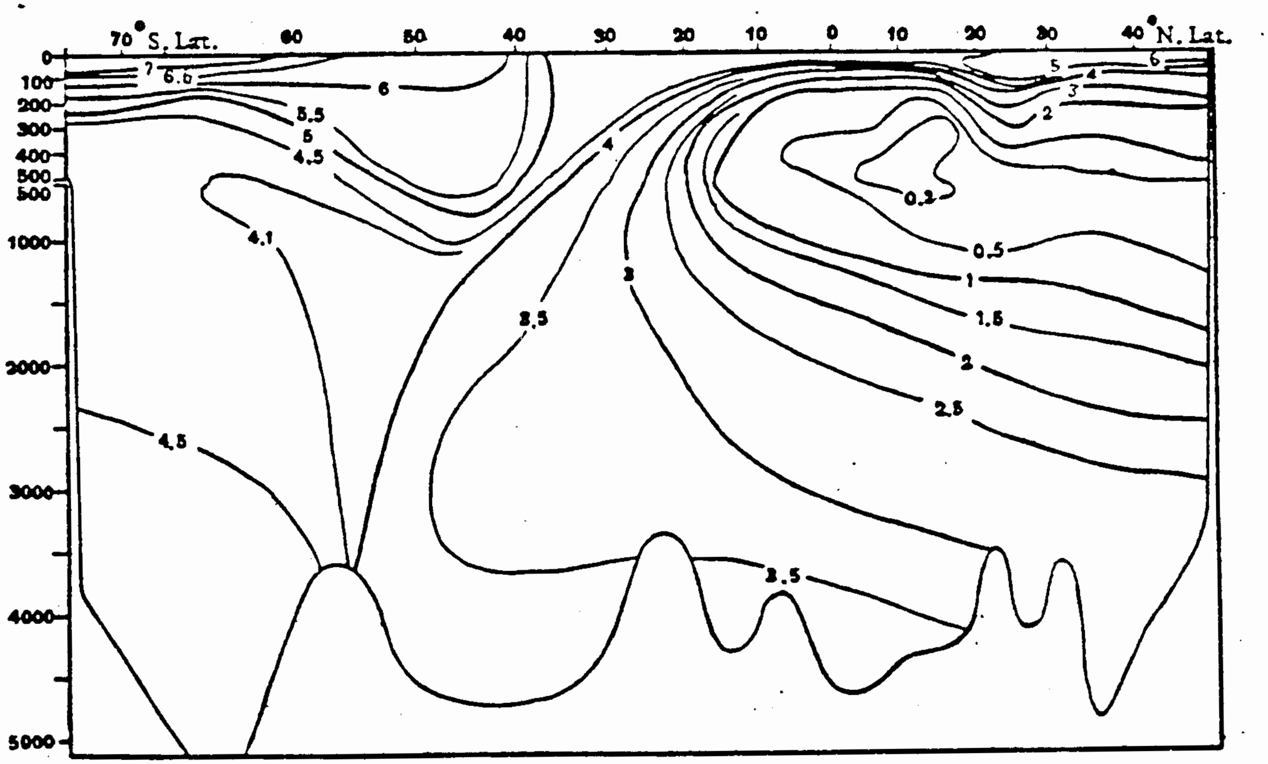


Figure III.26. Profile of dissolved oxygen from south latitudes to north latitudes along 170°-180°W (after Muromtsev, 1983).

profiles along 170^{o}-180^{o} W. It can be seen that the local waters are supersaturated, above the mean of 4.1 mg/l indicated by Muromtsev (1963).

The pH data varied closely around 8.2 except for occasional measurements of slightly below 8.0 in the waste field. Both ammonia-N and BOD_5 measurements were elevated significantly in the presence of wastes in the receiving waters and both BOD_5 and ammonia-N showed at least significant statistical correlation with one another during the 1982 and 1983 cruises (Soule and Oguri, 1984). BOD during the 1987 monitoring studies (SOS, Environmental, Inc., 1987) could not be closely related to the dispersing wastes since the design of the sampling program did not permit constant monitoring of the waste field itself.

Total nitrogen, total phosphorus and total solids, both suspended and volatile, were routinely measured during the five cruises in 1987 (SOS, Environmental, Inc., 1987a-e). Although there was considerable variation overall in these parameters there was a tendency for elevated values to appear in the data for near surface samples in the immediate wake of the discharging dump vessel. Calculations of immediate dilution, based on measurements of the waste prior to dumping compared to samples in the immediate wake of the discharging dump boat, suggest that immediate dilution is about three to four orders of magnitude.

III.B.4. REGIONAL GEOLOGY AND SEDIMENT CHARACTERISTICS

III.B.4.a. Regional Geology

Information and speculation on the origin of the tropical mid-pacific islands dates from the time of Charles Darwin in the nineteenth century. Darwin developed his well known theories of evolution of species and his perhaps less well known geological theories during the famous voyages in 1831-1836 of the research vessel *Beagle*, which traveled both coasts of South America and crossed the south Pacific (Darwin, 1839; 1843; 1844; 1859). Darwin was the first to speculate that the mid-Pacific area had once been at much higher elevation and subsequently subsided. Some fringing reefs continued to grow upward in the photic zone as the cones sank, but others sank without reefs being able to grow up from them because they subsided too fast or the water was too cold.

Menard (1964) placed the Samoan Islands as being on the western margin of the large mid-Pacific area of deep but elevated sea bottom, named the Darwin Rise in recognition of his historic observations. The Rise, originating in vulcanism on a scale unique in geological history, was created by hundreds of volcanoes pouring forth fluid lava, burying ridges and troughs in huge archipelagic aprons, followed by sedimentation (Figure III.27).

III.B.4.b. Geology of American Samoa

The Samoan Islands were formed by a series of volcanic eruptions along faults in the ocean floor which trended from the northwest to southeast. The volcanoes rose from thousands of meters in depth to heights above sea level of over 1000 meters, with lava flows merging to form islands on the Samoan ridge (Stearns, 1944; ASG 1981b).

Tutuila Island was formed from four major volcanoes in the Pliocene

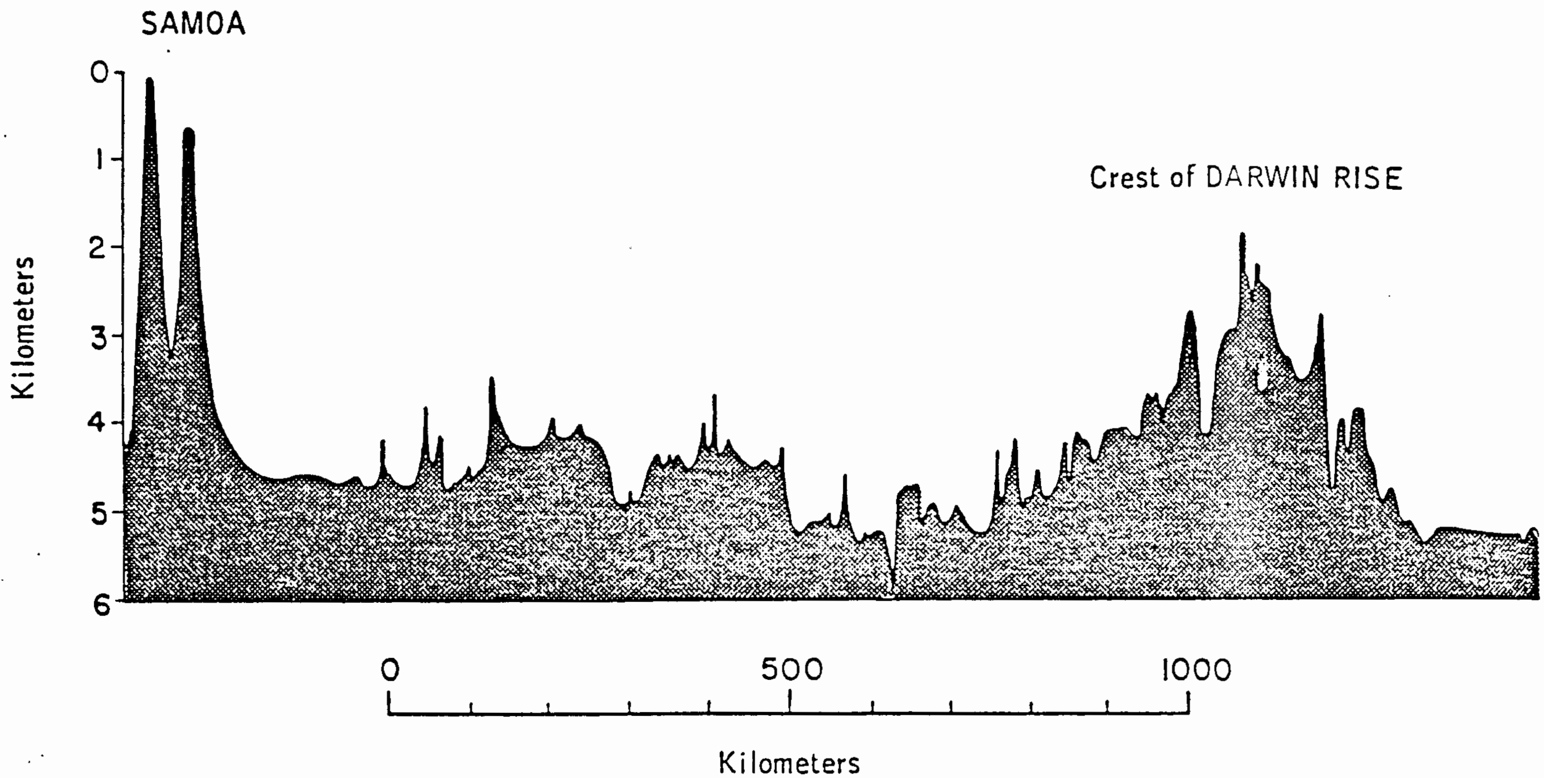


Figure III.27. Profile across the Darwin Rise showing the Samoan Islands on the periphery (Menard, 1964).

or early Pleistocene geologic period, creating shield shaped masses that merged into the island. The cones of Pago and Alofau volcanoes collapsed, forming two enormous calderas. After the four centers ceased activity, deep valleys were cut by streams, slopes were eroded and the shoreline was attacked by waves, reducing the landmass to roughly the present size near the end of the Pleistocene. In geologically recent times, a fifth volcano became active and the flow built the Tafuna - Leone Plains on the south-west of the island, while a small underwater eruption created Aunu'u Island at the east end (See Figure III.28).

The Samoan Islands have been said by various authorities to have subsided, as evidenced by limestone blocks below the zone of living coral and above the basaltic slopes offshore. However, this is attributed by others to lower sea levels during the Ice Ages, the last of which was about 10,000 years ago. The change in sea level resulted in the death of much of the coral in the fringing reef.

Tutuila is composed chiefly of basaltic and andesitic rock that erupted from the five volcanoes as *aa* (rough) and *pahoehoe* (ropey) lava. Flows range from thin bedded flows with high permeability, such as the Tafuna - Leone Plains, to thick bedded dense flows with low permeability, characteristic of much of the rest of the island. Thin bedded flows are too permeable to serve efficiently as groundwater resources, whereas water quickly runs off the thick, dense flows; thus water resources are limited throughout the island. Neither type makes good substrate for landfill of highly liquid wastes, since high percolation areas allow contaminants to migrate into the water table, and low permeability areas cannot accommodate sufficient quantities of wet wastes.

III.B.4.c. <u>Geology of the Dumpsites</u>

The geology of the dumpsites must be inferred from the known

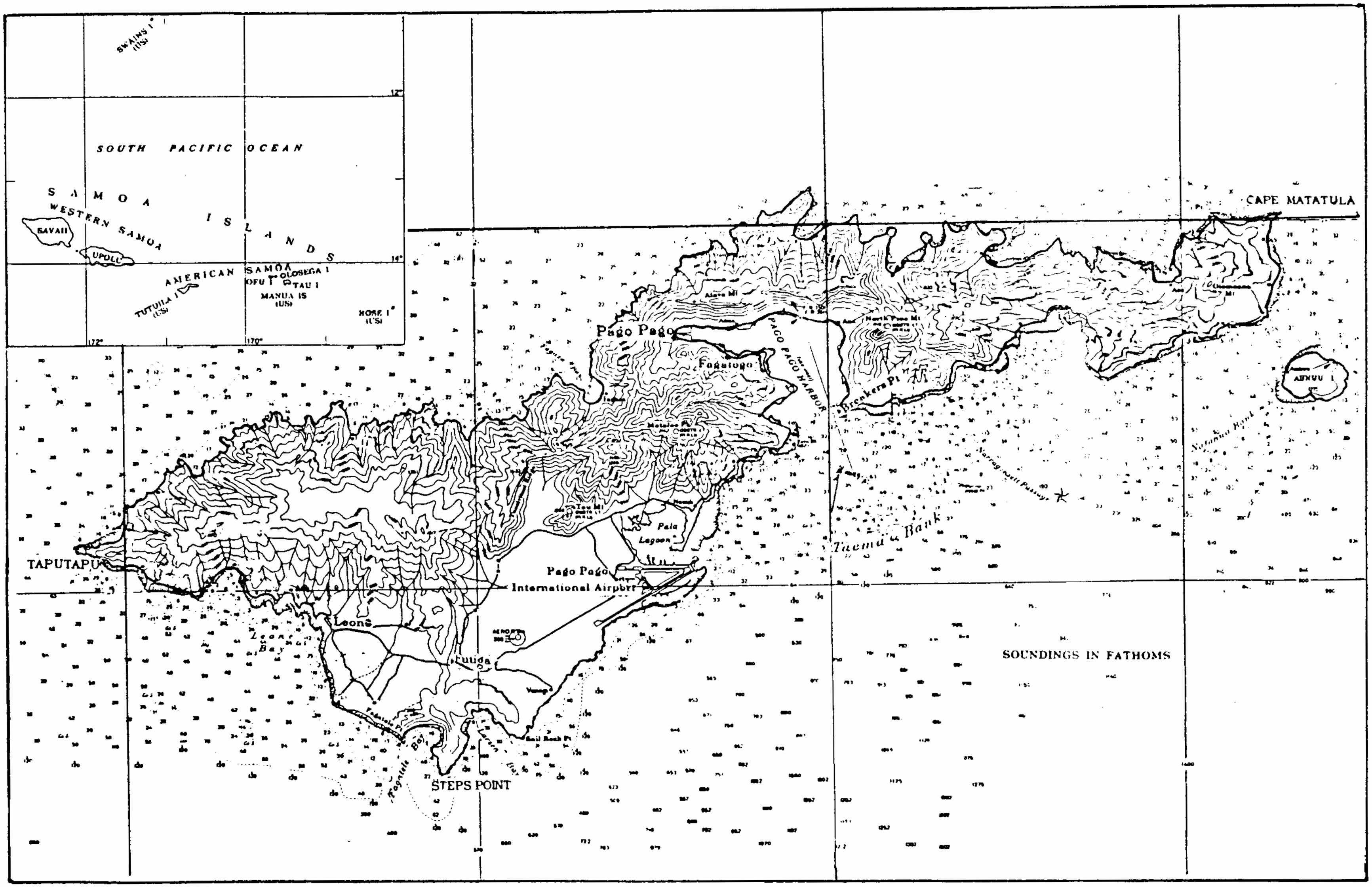


Figure III.28. Tutuila Island, showing volcanic mountains, coves and craters and the lava-based Tafuna-Leone plains (between Leone village on the west to the Pago Pago airport); Aunuu Island is to the east.

terrestrial geology (Stearns 1944; ASG, 1981b), since no cores have been taken from the offshore areas in question. The giant Pago volcanic caldera extended from west of Tau Mountain to the east side of Pioa (Rainmaker) Mountain east of Pago Pago Harbor, north to the shores, and south to Taema Bank. The south side of the giant caldera collapsed in prehistoric times, and the harbor was created by riverine erosional flow. The 120 fm contour is taken as the probable original outline of the island, and the slopes beyond that descend steeply to depths in excess of 1500 fms. The extra-caldera material consists of upper andesitic and basaltic flows, with associated cones, dikes and plugs, and lower thin bedded primitive basaltic flows with associated cones and dikes older than the caldera.

The present dumpsite, and the previous one, are probably underlain by the extra-caldera material, possibly with an admixture of olivine *pahoehoe* basalt from the much later Leone-Tafuna flow. Where the bottom is level and irregular enough to hold depositional materials, the volcanic flows would be overlain with calcareous sands from the fringing reefs and alluvium from coastal erosion and drowned valleys.

The deeper water site probably consists of bare, steeply sloping basaltic and andesitic rock, with pockets of calcareous sand in sheltered crevices. The interface of the water masses (Section III.B.3) in the general area may cause deep water mixing and downwelling within the area, which would preclude extensive sediment accumulation, even if relatively level terraces were present, until maximum depth is reached. The general bottom slope is southward toward the Tonga Trench, which begins its descent less than 200 n mi south southwest of Tutuila Island, ultimately reaching depths of 10,000 m.

III.C. BIOLOGICAL ENVIRONMENT

Vast areas of the tropical oceans are low in nutrients and support very low primary productivity (autotrophic bacterioplankton, single celled phytoplankton); hence they are low in production of invertebrate and fish life. The tropical high islands, with small fringing or patch reefs and with input of terrestrial nutrients, support a more extensive biota of invertebrates and fish, but the relatively limited extent of those reefs in turn limits total production. Large coral reef systems are highly productive, but nutrient levels in the water column are low due to rapid utilization and recycling at all levels of the food web.

III.C.1. PLANKTON

III.C.1.a. Phytoplankton and Zooplankton

Plankton resources are low in the tropical Pacific oceans as compared with those typical of coastal temperate ocean waters. Vinogradov (1981) showed that the peak levels of plankton productivity of the tropical Pacific follows the contours of the South Equatorial Current westward off South America in a narrowing wedge. As the wedge extends across the central equatorial Pacific, the density of plankton decreases and areas peripheral to the current system support very limited quantities of plankton (Figure III.29). The planktonic ecosystem is very complex.

Newly upwelled waters at the equatorial convergence are nutrient poor, and there is a lag time prior to development of phytoplankton and then feeding zooplankton communities. By the time that the zooplankton community is fully developed, it may have traveled several hundred km laterally and 1800-2500 km zonally from where the plankton originated. Small fish and cephalopod molluscs reach maximum density about four months

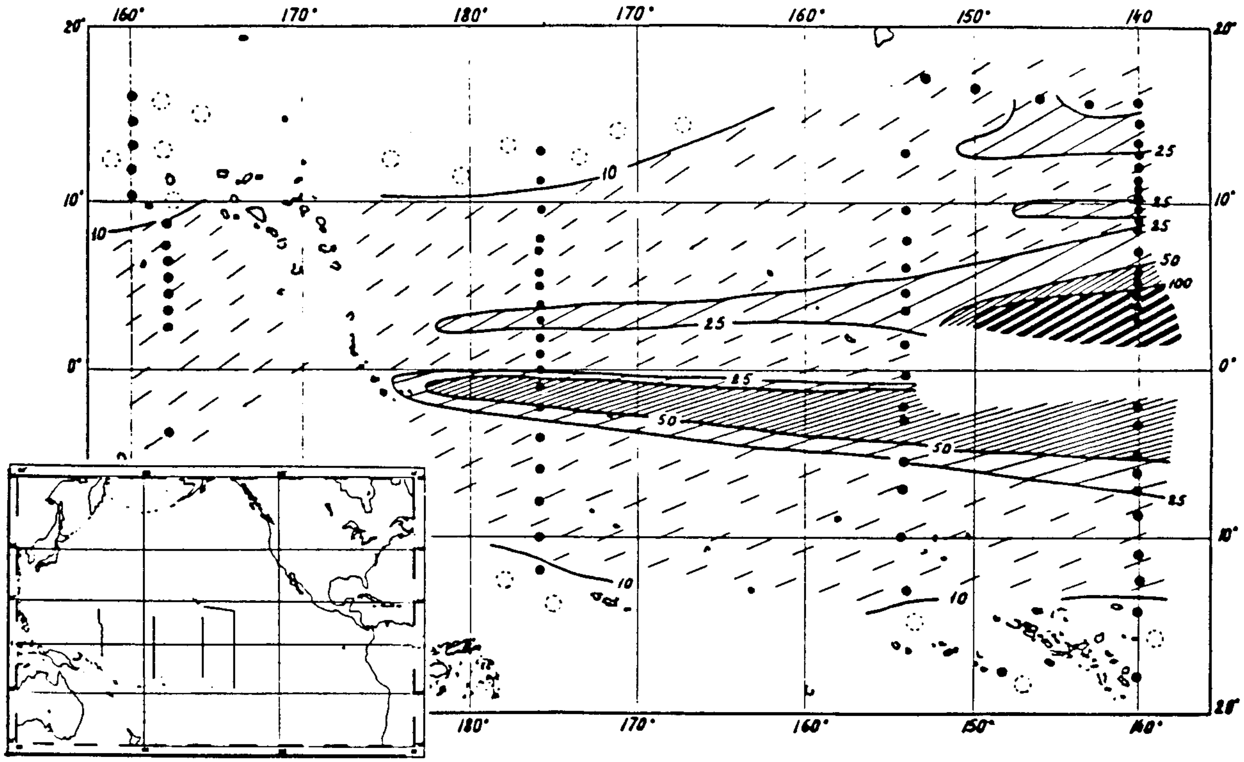


Figure III.29. Plankton densities in equatorial waters/m^3. American Samoa is at $14^{\circ}17'$S by $170^{\circ}40'$W, south of the 10 ml per m^3 area (after Vinogradov, 1981).

after the development of the chlorophyll maximum. Zooplankton, in daily vertical migrations, move up and down through the current and countercurrent, and are normally carried westward by this activity. The large fish, including migratory tuna that pass American Samoa, concentrate to feed in the zone of convergence between the South Equatorial Current and the Equatorial Countercurrent (Vinogradov, 1981).

In the nearshore waters of high (volcanic) islands such as Tutuila Island, plankton densities are usually low, due in part to the lack of extensive shallow water areas, and of mechanisms in the circulation patterns which would concentrate plankton around the islands. The patch and fringing reefs would be expected to show the low levels of nutrients associated with the rapid nutrient recycling typical of coral reefs. Zooplankton are present, but differ from the pelagic plankton species found in various water masses. Meroplankton, the temporarily planktonic larvae of organisms that are sedentary or attached as adults, occur in the water column of shallow water reefs. The planktonic larvae of molluscs, squid, nautiloids, crustaceans and fish that swim in oceanic waters as adults, which are also included in the meroplankton by some authors, are prominent in tropical oceanic waters. Because the Western Samoa Islands have much more extensive shallow water reef areas, the nearshore waters may attract predator species more than do the waters off American Samoa, with more limited shallow water areas.

III.C.1.b. <u>Detrital Food Web</u>

Traditional food chain concepts have often placed the base of the food web on phytoplankton, followed by grazing and carnivore zooplankton, and then by larger invertebrates and fish. However, it is now recognized that the role played by microbial organisms may be as important as algae, or more important, at the primary level of the food web in forming the true base for the detrital food web. The detrital food web is the principal support for deep sea biotic production in which plankton play no part except as fecal pellets or dead matter descending to the bottom (Sorokin, 1981; Jannasch, 1979; Soule and Soule, 1981). Concentrations of microzooplankton (microheterotrophs) accumulate near the upper boundary of the thermocline (Figure III.30.a.b.) where the biomass of protozoa and meroplankton may exceed that of the euphotic zone by an order of magnitude, and may greatly exceed that of the intermediate sized mesozooplankton (Sorokin, 1981).

The microheterotrophs that biodegrade the fish cannery wastes dumped in the ocean may in fact accumulate at 100 - 200 m, at the thermocline, but no sampling program for them is practical in American Samoa, given the difficulties of such a program in that area remote from laboratory and ship facilities. Fish processing wastes contain amino acids and dissolved organic material (DOM), as well as particulate organic matter (POM). Stephens (1981) has investigated over some 20 years the direct uptake of DOM from seawater by a variety of marine organisms, and demonstrated that representatives of most major invertebrate groups are capable of absorbing complex dissolved nutrients directly from seawater. POM provides a substrate for increasing microbial densities, which in turn provide particulate food for zooplankton and larvae of fish and invertebrates.

While there is no published offshore plankton study from American Samoa, the deep blue or light blue color of the nearshore waters indicates a lack of phytoplankton densities that would support a standing stock of zooplankton, suggesting that oceanographic concentrating mechanisms are not present. The terrestrial input of nutrients from runoff from areas

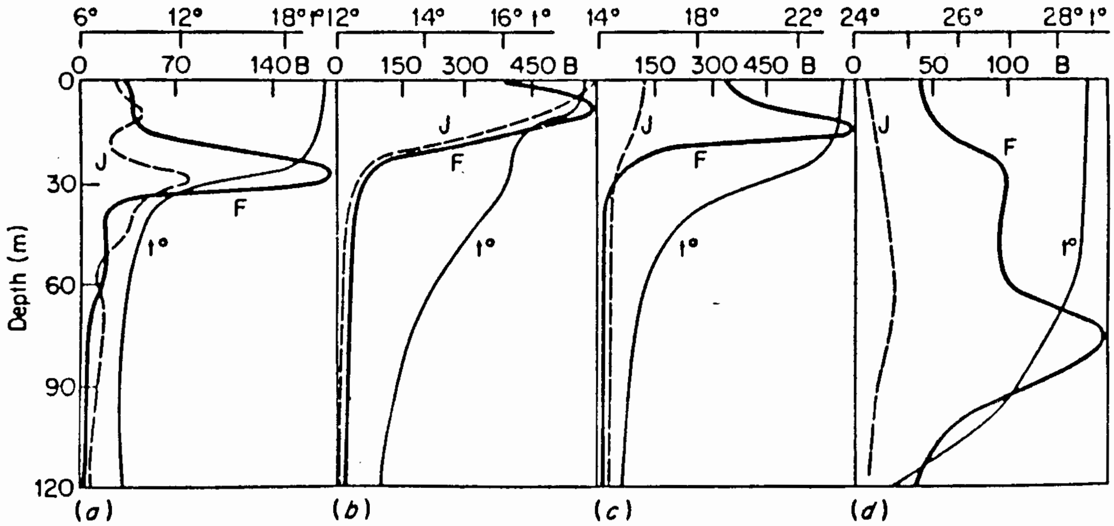


Figure III.30.a. Vertical distribution of protozoa: ciliates (J) and zooflagellates (F) in different marine planktonic habitats: (a) in the Black Sea; (b) in the Peruvian coastal waters south of intensive up-welling; (c) in the Peruvian upwelling region after the 'red tide'; (d) in the trade wind area of the South Pacific. B, biomass, mg m^{-3}, wet weight; $+^{0}$, temperature (from Sorokin, 1981).

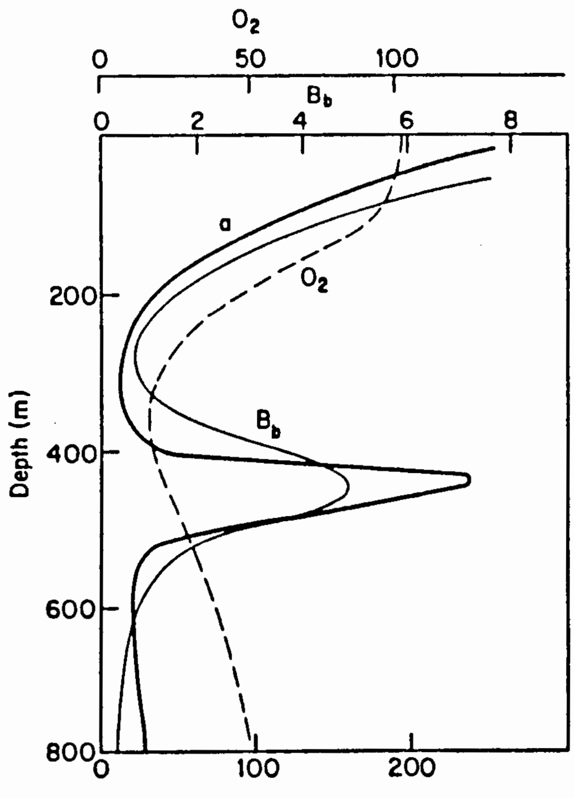


Figure III.30.b. Distribution of the microbial biomass (B_b, mg m^{-3}) on vertical profile in the equatorial Pacific O_2, dissolved oxygen, % of saturation, a, microbial activity, relative values (Sorokin, 1981).

such as Pago Pago Harbor and the coast apparently are dispersed rapidly, although eutrophic conditions (phytoplankton blooms) occur at times in the inner harbor, when concentrations of diatoms and dinoflagellates are high (USACOE, 1978).

Monitoring (Soule and Oguri, 1983a; 1984) indicated that water at the dumpsites prior to the day's dumping was either deep blue (Forel-Ule Scale I), indicative of water with very low productivity, or lighter blue (Forel-Ule II or III). The lighter blue colorations sometimes observed prior to dumping may be indicative of development of a microheterotrophic plankton population (bacteria, fungi, protozoans), which is known to exist at 100 m to 400 m depths near the equator. If circulation mechanisms did exist to retain this material, zooplankton production might be increased sufficiently to contribute to the support of a bait fishery. However, since wind and currents would disperse nutrients quickly, plankton densities probably remain low, and small pelagic fish are scarce away from nearshore waters.

III.C.2. BENTHIC ALGAE

No survey of benthic algae has been conducted in the vicinity of the dumpsites, since the benthos (bottom) is too deep and too sloping to support a standing crop. The limit of the photic zone, the depth with sufficient light penetration to support the growth of algae, is about 200 m. Dahl (1972) reported on the algae of Tutuila reefs, but other surveys of the shallow water reefs have not usually included algae. Ongoing surveys of the National Marine Sanctuary at Fagatele Bay, at the west end of Tutuila Island, included algae in shallow water transects (Birkeland et al., 1985). However, such survey data would be germane to the dumpsites only if wastes were expected to reach coral reef habitats while undiluted, and hence at toxic concentrations, or if turbidity were increased sufficiently to inhibit coral/algae growth. No wastes reach Fagatele Bay, and monitoring studies, as well as model calculations (Appendix B), indicate that the wastes will not reach the reefs and shallow water areas which are closer to the present dumpsite than is Fagatele Bay. **The preferred dumpsite is more distant, 5.16 n mi from the reefs.**

III.C.3. BENTHIC INVERTEBRATES

Benthic surveys of marine invertebrates have been carried out on the shallow water reef habitats, mostly emphasizing corals (Dahl and Lamberts, 1977) or corals and fish (USACOE, 1980; Randall and Devaney, 1974; Helfrich, 1975; Dahl, 1971). Isolated studies conducted for particular projects have included surveys in limited areas such as Pago Pago Harbor (e.g., Dames and Moore, 1974), or Fagatele Bay (Birkeland et al., 1985) but many of these reports have had very limited distribution or are no longer available to the public.

III.C.3.a. Crown of Thorns Starfish

Of particular concern has been the impact on the shallow water benthos of the Crown of Thorns starfish (the echinoderm *Acanthaster planci*), which decimated corals around Tutuila Island in 1977-1979. A plate-sized animal with multiple arms, covered with large spines, this species is normally not common there, being found on the reef front in small numbers. However, in mid-1977, large aggregations moved up from deeper water seaward of Taema Bank, near the site evaluated as the shallower water dumpsite. From there, the starfish spread onto the patch reefs and Nafunua Bank, and thence counterclockwise around the island, being found in dense aggregations on virtually all the coral in Fagatele Bay in April 1979. Typically, they devour the living coral polyps, feeding at night. Often, entire coral heads are killed and cannot resume growth. Although the Crown of Thorns (locally called "Alamea") returned to normal populations after 1979, algal growth quickly covered the dead coral heads. When entire coral heads are killed, new coral growth becomes dependent on natural reintroduction of coral larvae from undecimated adjacent reefs. New growth is especially vulnerable to predation by coral eating or omnivorous fish as well as other echinoderm species of starfish and sea urchins.

The echinoderms are generally detritivores and may be stimulated by enrichment from terrestrial runoff or urban wastes. The literature is extensive on the Crown of Thorns phenomenon, since large areas of the Australian Great Barrier Reef were decimated by them in the early 1970s (eg., Endean, 1974, in the Great Barrier Reef Symposium of 1973). No conclusion has been reached as to what stimulates the episodic population explosions and migrations; so far as is known, there was about a 40 year interval between episodes at Tutuila Island. While total populations of reef fish were seemingly not much reduced, the species composition was altered in favor of algae eaters or omnivores while those that are obligate coral feeders decreased or disappeared (USACOE, 1980; Hourigan et al., 1988).

The present dumpsite and the deeper water preferred dumpsite have not been surveyed for benthic invertebrates. The steep slopes and rocky substrate would probably preclude the existence of significant benthic populations of marine annelids (polychaetes), shellfish (molluscs), or crabs and shrimp (crustaceans). The present site is probably less precipitous and may have small pockets of coral sediment with infauna present, in contrast to the deeper water site. Soft corals may also be present, clinging to the faces of escarpments.

III.C.3.b. Pelagic Invertebrates

The principal planktonic invertebrates known to frequent the area off Tutuila are large cephalopod molluscs, *Nautilus pompilius*, and more rarely, *Nautilus micromcephalus*. According to Ward and Martin (1980), who studied the species off Fiji and New Caledonia extensively, the youngest members of a school of nautiloids are in deeper waters, from 300 to 600 m, and farther from shore. There they are presumably more protected from predation by large carnivores such as reef fish, moray eels, sharks and sea snakes, and from wave turbulence. Tuna apparently feed on natiloid schools as well. Adult nautiloids are found mainly closer to shore, although they occurred at all depths sampled. Recently a number of these "living fossils", with their large brown and white multi-chambered shells, have been caught off Tutuila for display by Honolulu Aquarium personnel, with the assistance of the ASG Office of Marine and Wildlife Resources. The adults apparently migrate up the reef face at night, feeding with their large beaks on reef fish and on lobster and other crustaceans. Ward and Wicksten (1980) found that hermit crabs were also a favored food of nautiloids and they are capable of ingesting carapaces (exoskeletons) shed during molting of lobsters and other crustaceans, digesting the organic material attached to the chitinous shells.

III.C.4. FISH

III.C.4.a. Demersal Fish

Demersal (bottom feeding) fish populations are unknown from the offshore areas of Tutuila Island. The low level of nutrients at both the present and preferred dumpsites, and the lack of a benthic biota, would seem to preclude the presence of significant numbers of demersal fish.

The lack of a sizeable bait fishery offshore confirms this assumption. Fish diversity in the coral reefs is high, although numbers are not large, according to Dr. Richard Wass, who conducted the fish survey for the coral reef inventory (USACOE, 1980). Some deep water seamount fish such as armorheads (Pentocerotidae) and alphonsins (Berycidae) congregate along steep slopes but at slightly shallower depths than those of the present and preferred sites (Dr. R. Wass, U.S. FWS, pers. comm.).

III.C.4.b. Pelagic Fish

Beyond the reefs, pelagic fish include skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*), which are fished commercially throughout the tropical south Pacific. Other commercial species may be caught near the islands, but most are caught well to the west of American Samoa and delivered frozen to the canneries for processing. Marlin (*Makaira*, spp.), sailfish (*Istiophorus platypterus*) and dolphin fish (*Coryphaena*, spp.) provide good sport fishing off Tutuila Island at times. Wahoo (*Acanthocybium solandri*), a member of the tuna family but classed as a game fish in regulating the fishery, can be caught for commercial canning only if consumed in American Samoa. Schools of young skipjack (*Katsuonus pelamis*) and kawakawa (*Euthynnus affinis*) were observed, and caught on occasion during monitoring in 1982-1983. The more mature tuna generally stay well out to sea. As migratory species, they are apparently cued by water transparency to avoid inshore areas and feed on fish that venture farther from shore or on smaller pelagic species, and on squid and crustaceans. Thus it was observed in 1982-1983 that when tuna encountered the dump plume, they veered around it to seaward. This contrasts with the behavior of pelagic mackerel and anchovy studied off Los Angeles (Soule and Oguri, 1982), which seemed attracted to the turbid waters and waited in position for the dump vessel to arrive. The coaguluum particles sank in the water column, and the fish could be observed on Sonar to follow the particles downward in the 20 fm deep water, returning to the surface each time the dump vessel passed.

III.C.5. COASTAL BIRDS

Coastal birds are numerous around the cliffs surrounding Fagatele Bay, a National Marine Sanctuary (NOAA/ASG, 1984) but are otherwise seen in small numbers. Table III.8, (Areas 1 and 5) from NOAA/ASG, 1984, lists 13 species that are marine oriented, either nesting or feeding in Fagatele Bay, or found feeding along beaches and nearshore reefs. Grey-backed terns (*Sterna lunata*) appear to feed on the schools of small pelagic fish, including young tuna, whether or not the fish are in the waste plume.

III.C.6. MARINE MAMMALS

The waters off the Samoan Islands are important to a group of the endangered humpback whale (*Megaptera novaeangliae*), from the southern hemisphere breeding population (NOAA/ASG, 1984; Baker, 1987) which has been decimated. Each year, from July to October, this population is reported to use shallow waters off the western end of Tutuila Island, and in Western Samoa for breeding and calving. Two pods of humpback whales, one with a calf, were seen one mile off Papualoa Pt. (Vailoatai), north-west of Fagatele Bay in September, 1987 (J. Naughton, NMFS, pers. comm.). The noise from these 30 to 50 ton whales as they breach and smack the surface with their tails during aggressive mating behavior can clearly be heard on Western Samoa. **They are less frequently sighted off the southern side of Tutuila Island.** They bask in shallower waters with calves during the day and adults may move into deeper water at night. Whale Rock in outer Pago Pago Harbor was purportedly named because whales visited this

Table III.8. Commonly Sighted Birds Around Fagatele Bay (U.S. NOAA/ASG, 1984).

Common Name	Samoan Name	Scientific Name	Areas of Use 1*	2*	3*	4*	5*
Brown booby	Fua'o	*Sula leucogaster*	N-F				
Red footed booby		*Sula sula*	N-F				
Grey-backed tern		*Sterna lunata*	N-F				
Black noddy		*Anous tenuirostris*	N-F				
Blue-grey noddy	Laia	*Procelsterna cerulea*	N-F				
Great frigate bird		*Fregata minor*	N-F				
Brown noddy	Gogo	*Anous stolidus*	N-F	N			
White-tern	Manu sina	*Gygis alba*	N-F	N			
White-tailed tropic birds	Tava'e	*Phaethon lepturus*	N-F	N			
White rumped swiflet**		*Collocalia spodiophygia*			N-F		
Red vented bulbul**		*Pycnonotus cafer*			N-F		
Samoan starling**		*Aplonis atrituscus*			N-F		
White collared king fisher**		*Halcyon chloris*			N-F		
Cardinal honeyeater**		*Myzomela dibapha (?)*				N-F	
Wattled honeyeater**		*Foulchaio carunculata*				N-F	
Reef heron**		*Egretta sacra*					F
Wandering tattler**		*Tringa incana*					F
Plover**		*Pluvialis sp.*					F
Turnstone**		*Arenaria interpres*					F

* 1 Sea Cliffs/Bay
2 Coastal Forests
3 Interior Slopes and Valleys
4 Coastal Plain
5 Beach and Nearshore reefs

** Specifically noted along Leone Bay about 2 miles northwest of Fagatele Bay.

N Nesting
F Feeding

very rich shallow area, and there are unsubstantiated reports that whales visited the site within the past two years; 3 pilot whales (*Globicephala scammoni*) were reported in the plume in December, 1987.

Occasionally, endangered sperm whales (*Physeter catodon*), are sighted in offshore waters around American Samoa, and may be encountered seaward of Fagatele Bay. Spinner dolphins (porpoises) (*Stenella longerostris*), commonly school in Fagatele Bay and Leone Bay, on the southwest coast (See Figure III.28), more than 4 n mi and 7 n mi respectively from the center of the present dumpsite. The preferred site is almost 2 n mi farther away.

III.C.7. RARE, THREATENED OR ENDANGERED SPECIES

In addition to the endangered whale species discussed in the previous paragraph, waters off American Samoa host several species of turtle, including the endangered hawksbill turtle (*Eretmochelys imbricata*), and the threatened green sea turtle (*Chelonia mydas*). Occasionally the endangered leatherback turtle (*Dermochelys coriacea*), the threatened olive Ridley turtle (*Lepidochelys olivacea*) and the loggerhead turtle (*Caretta caretta*) are seen in the general area but were not sighted during monitoring. Table III.9 from NOAA/ASG. 1984, and others gives a list of the endangered and threatened turtles and their historic range.

III.C.8. POTENTIAL FOR DEVELOPMENT OR RECRUITMENT OF NUISANCE SPECIES

Prior to Federal waste regulation, and to recovery of wastes for pet food or fishmeal, cannery wastes included heads, guts and chunks of flesh as well as particulates, all of which were dumped into the harbor. Sharks were large and plentiful, feeding on the chunks of waste or on the smaller fish feeding on particulates. Sharks are not filter feeders and are not attracted to the waste plume itself or to liquid wastes permitted for disposal in the harbor. If a small school of pelagic fish is in the dumpsite area, sharks may pursue them through the plume, but lower visibility would protect the prey. Sharks were seen occasionally in the vicinity of the Fish Attraction Device (FAD) buoy off to the south of Steps Point, where small fish are expected to congregate. Disposal of the wastes has not caused an increase in the shark population offshore.

Table III.9. Threatened and Endangered Species Sighted in Vicinity of Fagatele Bay (from U.S. NOAA/ASG, 1984; J. Naughton, NMFS, Personal Communication).

Common Name	Scientific Name	Historic Range	Status
Turtle, green sea	*Chelonia mydas*	circumglobal in tropical and temperate seas and oceans	T
Turtle, hawksbill (= Carey)	*Eretmochelys imbricata*	tropical seas	E
Turtle, leatherback	*Dermochelys*	tropical, temp- erature and subpolar seas	E
Turtle, loggerhead sea	*Caretta caretta*	circumglobal in tropical and temperate seas and oceans	T
Turtle, olive (Pacific) Redley sea	*Lepidochelys*	circumglobal in tropical and temperate seas and oceans	T
Whale, humpback	*Megaptera Novaeangliae*	antarctic to tropical islands (southern population)	E

III.D. SOCIOECONOMIC ENVIRONMENT

The socioeconomic environment of American Samoa is very different from that of the mainland because it is strongly influenced by the *aiga*, the extended family unit, and the *matai*, the hereditary chiefs of those units (USACOE, 1978). Most of the village lands are held by the *aigas*.

The Samoan people are Polynesian, with a strong component of Melanesian origin. The population of American Samoa was surprisingly homogeneous in 1974 (ASG, 1981c), with 85% to 90% of the population considered "pure" Samoan. About 8% to 10% were part Samoan, and 3% to 4% were foreigners (Caucasians), most of whom live in central or western Tutuila; Tongans composed up to 3% and Koreans up to 1%. Other Pacific peoples provided 1.8% of the population. The total population of the American Samoa islands was about 32,000 in 1980 (ASG, 1981d); Iversen (1987) reported it as 35,000 in 1986. Tutuila Island has most of that population, with only a few thousand scattered among the other islands.

According to the 1974 census 57% of the males and 45.3% of the females, over the age of 15 and considered economically active, were employed by the American Samoa Government; the number of employees was almost triple the number so employed in 1960 (ASG, 1981c; Dieudonne, 1988). Almost 50% of the people were listed as economically inactive or dependents, while 40% were supported by paid employment, and about 10% were supported by "other" means. Of the "other" category, 30% were on Social Security, 21% were on Veteran's benefits, 16% were on retirement income, and 13% were supported by private means. The American Samoa *aiga* supported 8%, mainland *aiga* supported 7% and Hawaiian *aiga* supported 1%. The tuna canneries employ about 4,000 people, or 25% of the work force; about 3,800 are workers covered by minimum wage laws (Iversen, 1987).

III.D.1. COMMERCIAL FISHING

III.D.1.a. Role of the Tuna Processors

Commercial fishing, except for a small fresh fish market, is not generally practiced by American Samoans. They do not care much for recreational fishing, although subsistence fishing and gleaning are widely practiced. American Samoans do not wish to ship out on the cramped, decrepit, predominantly Korean or Taiwanese longliner fleet, or to be at sea for weeks on the tuna clippers. However, the tuna canneries provide 98% of the exports from American Samoa (ASG, 1981d), and the ASG has given significant tax incentives to the canners to remain as the largest private employers in the islands.

III.D.1.a.1. Federal Tariffs

According to Schug and Galea'i (1987), two important Federal decisions have been crucial to the development of the tuna industry in American Samoa. In 1953, the U.S. Bureau of Customs ruled that fish caught by foreign flag vessels could be landed there. The Japanese fishing fleet had dominated south Pacific tuna fishing up to that time. Second, under U.S. Tariff Schedules, exports from American Samoa are accorded duty free entry into the United States if the foreign component of the product is less than 50% of its market value. This criterion is easily met, regardless of the origin of the raw fish, after processing costs are added. The duty free status is especially important for tuna packed in oil, which would otherwise be subject to a 36% ad valorum tax. Duty on water packed tuna is only 6%, increasing to 12 % whenever the quantity imported into the United States exceeds 20% of the amount canned in the United States (excluding American Samoa production) in the preceeding year. There is now only one significant tuna processor on the mainland, and the principal competition is water packed tuna, which has increased in popularity, mostly from Thailand. In 1985, Thailand exported 122.6 million pounds, 57% of the total imports and a 37% increase over 1984 (Herrick and Kaplin, 1986); this increased to 135.4 million pounds in 1987, 70% of the import market (NMFS, 1988).

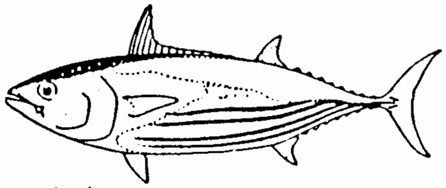
III.D.1.a.2. Foreign Longliner Fleet Catch

The Japanese longliners that formerly fished white meat albacore (*Thunnus alalunga*, Figure III.31) were largely replaced by Taiwanese and then by Korean operated longliners in the late 1960s and early 1970s, as economic changes occurred in Japan. In the 1970s, some 300 longliner vessels were based in Pago Pago Harbor (Schug and Galea'i, 1987), but the number has since declined greatly.

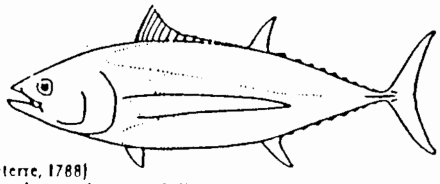
III.D.1.a.3. Purse Seiner Catch

In 1978 and thereafter, the southern California purse seiner fleet moved from the mainland because of disagreements with Mexico, Ecuador and Central American countries over their declared 200 mile territorial waters and tuna fishing rights, which the United States did not acknowledge.

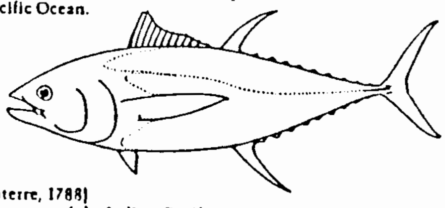
Purse seiner landings of skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*) surpassed those of white meat albacore, making American Samoa a high volume processor of light meat. Three tables from Schug and Galea'i (1987) illustrate the changes in the American Samoa tuna industry. Table III.10.a. indicates the estimated quantity of tuna, by species, taken in 1981-1985, while Table III.10.b. compares the estimated quantities of tuna packed in oil, in water, or as pet food and meal shipped from American Samoa to the United States from 1977 to 1985. Table III.10.c. compares total U.S. production with that of American Samoa. Closure of most of the tuna canneries on the American mainland,



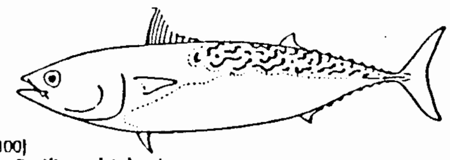
Skipjack tuna
Katsuwonus pelamis (Linnaeus, 1758)
Cosmopolitan in warm waters; absent from the Black Sea.



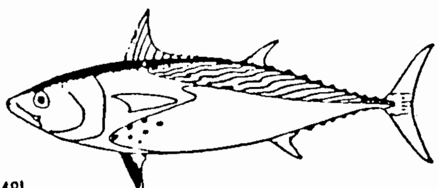
Albacore
Thunnus alalunga (Bonnaterre, 1788)
Temperate, subtropical and tropical waters of all oceans, including the Mediterranean Sea, but absent in the tropical waters of the eastern Pacific Ocean.



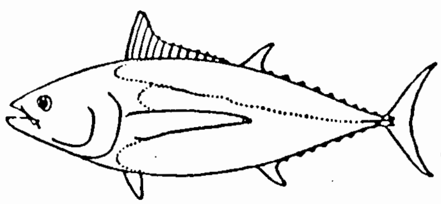
Yellowfin tuna
Thunnus albacares (Bonnaterre, 1788)
Tropical and subtropical waters of the Indian, Pacific, and Atlantic oceans.



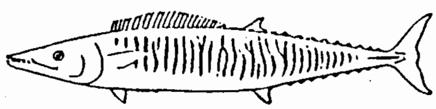
Frigate tuna
Auxis thazard (Lacépède, 1800)
Warm waters of the Indian, Pacific, and Atlantic oceans.



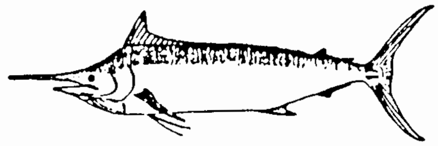
Kawakawa
Euthynnus affinis (Cantor, 1849)
Warm waters of the Indian and Pacific oceans; few records from the eastern Pacific Ocean.



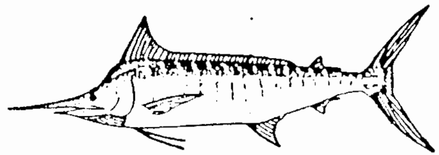
Bigeye tuna
Thunnus obesus (Lowe, 1839)
Warm waters of the Indian, Pacific, and Atlantic oceans.



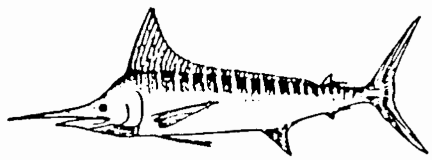
Wahoo
Acanthocybium solandri (Cuvier *in* Cuvier and Valenciennes, 1831)
Tropical and subtropical waters of the Indian, Pacific, and Atlantic oceans, including the Mediterranean Sea.



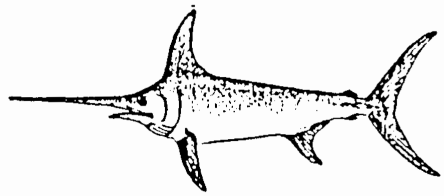
Black marlin
Makaira indica (Cuvier *in* Cuvier and Valenciennes, 1831)
Indian and Pacific oceans; sporadic occurrence in the Atlantic Ocean; tropical fish much more abundant in coastal waters than in waters of the open sea, where it is present only in small numbers.



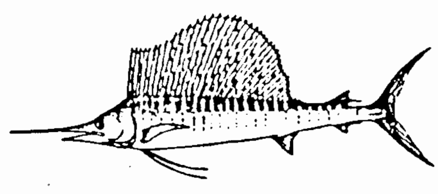
Blue marlin
Makaira nigricans Lacépède, 1802
Widely distributed throughout the Indian, Pacific, and Atlantic oceans; especially abundant in tropical regions; rare in the Mediterranean Sea.



Striped marlin
Tetrapturus audax (Philippi, 1887)
Warm waters of the Indian and Pacific oceans; relatively rare in equatorial regions of the central and western Pacific.



Swordfish
Xiphias gladius Linnaeus, 1758
Widely distributed throughout the temperate, subtropical and tropical waters of the world oceans and the adjacent seas; found in coastal as well as in oceanic areas.



Sailfish
Istiophorus platypterus (Shaw and Nodder, 1791)
Widely distributed throughout tropical and subtropical waters of the world oceans; usually more abundant near land masses and some of the larger islands.

Figure III.31. Commercially caught species (left column) in the western pacific and recreationally caught species (right column); after IATTC, 1979.

Table III.10.a. Estimated quantity of fish landed at tuna canneries in American Samoa by species 1981-1985

	Tonnes (000's)				
	Albacore	Yellowfin	Bigeye	Skipjack	Total
1981	20.1	16.9	2.6	23.6	63.2
1982	18.5	10.2	4.5	17.5	50.7
1983	18.9	33.1	4.7	78.8	135.5
1984	10.9	24.0	2.3	63.0	100.2
1985	14.8	24.0	1.7	69.5	110.0

Source: Compiled from unpublished monthly reports between 1981 and 1985 submitted by Star-Kist Samoa and Samoa Packing Company to the Economic Development and Planning Office, American Samoa Government.

Table III.10.b. Estimated quantity of shipments of tuna cannery products from American Samoa to the United States 1977-1985

	Tonnes (000's)			
	Canned tuna in oil	Canned tuna not in oil	Pet food	Fish meal
1977	8.9	7.0	4.1	1.6
1978	17.5	15.0	5.4	1.8
1979	21.9	12.5	5.7	2.1
1980	16.0	20.0	3.2	1.4
1981	15.1	28.8	5.4	1.9
1982	5.9	31.3	5.5	0.9
1983	34.8	42.5	8.1	1.0
1984	19.6	39.9	8.4	2.6
1985	26.7	36.3	11.0	2.8

Sources: U.S. Department of Labor 1986 and U.S. Bureau of the Census 1986.

Table III.10.c. Comparison of total U.S. production of canned tuna with American Samoa production 1977-1985

	Tonnes (000's)		
	Total U.S. production	American Samoa production	Percentage of U.S. production
1977	249.1	15.9	6.4
1978	320.4	32.5	10.1
1979	281.9	34.4	12.2
1980	273.6	36.0	13.2
1981	285.0	43.9	15.4
1982	244.8	37.2	15.2
1983	268.4	77.3	28.8
1984	279.2	59.5	21.3
1985	247.7	63.0	25.4

Sources: U.S. Department of Labor 1986 and U.S. National Marine Fisheries Service 1986.

located in southern California, shifted production to American Samoa and to Puerto Rico. Labor costs are lower in American Samoa, and American Samoa serves the entire western Pacific. Puerto Rico is the largest U.S. processor.

III.D.1.a.4. Processing and Exports

A comparison of processing and exports from 1982 to 1987, made by the National Marine Fisheries Service (NMFS) Southwest Region, is shown in Table III.11 (NMFS, 1988). NMFS is required, by agreement with the processors, to combine totals from at least three corporations, in order to insure a measure of confidentiality. Puerto Rico has five processors, but American Samoa has only two, so their data were combined with those of a processor in Hawaii. The Hawaiian processor subsequently became inactive and the California processors were reduced by plant closures in San Diego and Los Angeles in the 1983-1985 period, leaving only one significant mainland processor. Thus, all the Pacific tuna data had to be combined in NMFS reports.

III.D.1.a.5. Economic Benefits to American Samoa

Schug and Galea'i (1987) pointed out that much of cannery operation does not directly benefit American Samoans. Cannery management personnel come primarily from the mainland, the longliners and purse seiners are not owned or operated by Samoans, and a large percentage of the unskilled laborers are from Western Samoa. The unskilled labor force is composed in large part of women who work on the fish cleaning tables. Although the jobs are generally steady, the women often quit when the needs of the family group are otherwise met, or they wish to return to their families. Men do the bulk of the more physically demanding labor, and constitute about 30% of the cannery work force.

Table III.11. U.S. Tuna Cannery Receipts (short tons) by Processing Site and Direct Exports, 1982-87.

Species	California/American Samoa/Hawaii 1/							Puerto Rico						
	1982	1983	1984	1985	1986	1987	82-86 Avg.	1982	1983	1984	1985	1986	1987	82-86 Avg.
Domestic:														
Albacore	6,965	10,466	10,323	5,608	3,231	1,971	7,318	-	4	3.565	1,245	296	865	1,022
Skipjack	82,669	113,465	94,152	66,716	71,803	75,210	85,762	18,781	41.608	51,441	17,304	18,802	12,105	29,587
Yellowfin 2/	93,468	90,052	59,907	35,365	57,120	83,524	67,182	24,800	30,044	35,193	87,571	75,941	80,261	50,710
Total	183,102	213,983	164,382	107,689	132,154	160,705	160,262	43,581	71,656	90,199	106,120	95,039	93,231	81,319
Imported:														
Albacore	33,928	22,750	21,962	20,030	25,811	25,468	24,896	60,670	50,105	70,882	75,122	86,481	75,893	68,652
Skipjack	45,837	50,633	28,737	18,026	18,590	22,618	32,365	82,178	84,675	106,136	74,606	86,441	72,440	86,807
Yellowfin 2/	17,811	14,081	12,685	10,169	11,875	18,384	13,325	33,402	24,251	29,045	57,192	67,260	63,965	42,230
Total	87,576	87,464	63,384	48,225	56,276	66,470	70,586	176,250	159,031	206,063	206,920	240,182	212,298	197,689
Grand Total	280,678	301,447	227,766	155,914	188,430	227,175	230,848	219,831	230,687	296,262	313,040	335,220	305,529	279,008

Species	Direct Exports							Total						
	1982	1983	1984	1985	1986	1987	82-86 Avg.	1982	1983	1984	1985	1986	1987	82-86 Avg.
Domestic:														
Albacore	62	-	108	-	-	841	34	7,027	10,470	13,996	6,853	3,527	3,677	8,374
Skipjack	387	45	15,388	19,669	22,207	16,256	11,539	101,837	155,118	160,981	103,689	112,812	103,571	126,888
Yellowfin 2/	3,864	538	16,980	15,128	11,539	12,866	9,610	122,132	120,634	112,080	138,064	144,600	176,651	127,502
Total	4,313	583	32,476	34,797	33,746	29,963	21,183	230,996	286,222	287,057	248,606	260,939	283,899	262,764
Imported														
Albacore	-	-	-	-	-	-	-	94.598	72,855	92,844	95.152	112,292	101,361	93.549
Skipjack	-	-	-	-	-	-	-	128,015	135,308	134,873	92.632	105,031	95,058	119,172
Yellowfin 2/	-	-	-	-	-	-	-	51,213	38,332	41,730	67,361	79,135	82,349	55,554
Total	-	-	-	-	-	-	-	273,826	246,495	269,447	255,145	296,458	278,768	268,275
Grand Total	4,313	583	32,476	34,797	33,746	29,963	21,183	504,822	532,717	556,504	503,751	557,397	562,667	531,039

Note: Cannery receipts include imported and domestically caught tuna delivered to U.S. processors. Excluded are U.S. caught tuna destined for export or for the fresh tuna market and imported tuna destined for the fresh tuna market or designated as "flakes" and "not fit for human consumption." Direct exports include U.S. caught tuna landed directly in, or transshipped to a foreign country; excludes tuna exported from the U.S. east and west coasts.

1/ Although no tuna was processed or transshipped through Hawaii to U.S. canneries in 1987, the Am.S/Ca/Hi designation is maintained for 1987 in order to make historical comparisons

2/ Includes Bigeye, Blackfin, and Bluefin tuna.

Source: Statistics and Market News, Southwest Region, NMFS, NOAA.

U.S. Department of Labor Statistics gave the total number of employees covered by minimum wage in selected months of 1986 as fluctuating between 3,411 to 3,811 on an island with a total population of about 35,000. The canneries paid the highest minimum wages on the island at $2.82/hr in 1986 (Iverson, 1987).

Tuna processing profits accrue to parent corporations; Star-Kist Samoa is a subsidiary of H. J. Heinz in Pittsburgh, and Samoa Packing is a subsidiary of Ralston Purina in St. Louis. Both are multinational corporations which affect the tuna industry in all the Pacific countries and territories (Doulman, 1987). According to Alverson (1987), the flexibility of tuna industry management enabled the American corporations to survive unprofitable years for tuna in 1982-1984, when foreign imports and buildup of foreign purse seine fleets occurred. The major packers closed their mainland tuna processing plants and moved operations to American Samoa and Puerto Rico where tax incentives are favorable and labor costs are lower. The industry also divested itself of equity in fleet vessels and now buys tuna on the international market. Environmental legislation was extremely costly to fleet operations on the mainland, and problems with waste disposal on land were increasingly difficult to manage.

In spite of the relatively low retention of capital in American Samoa, the canneries are responsible for the direct or secondary income of 40% of the labor force, the private sector. Money is spent in American Samoa by management and labor for housing, food, clothing, household supplies and furnishings and local or off-island transportation. Some ships' chandlery and drydock repairs are done in American Samoa, although seiners may travel to New Zealand or other distant shipyards for major overhaul. The canners contribute about $20 million to the local economy

(Dieudonne, 1988). There is no question that there is a much larger "leakage" of funds from the local economy than is common in mainland economies. Most foods not grown in household gardens must be flown in or shipped in by cargo containers, as are household and other goods, since American Samoa produces very little of these. Foreign chain stores and shipping firms reap most of those profits. Western Samoans send much of their money out of Tutuila Island as well. However, the basic sector payroll from the canneries is the principal contributor to the island economy, and its loss would seriously impact the islands. The ASG gives significant tax incentives to the canners but does tax the diesel fuel sold to fishing vessels.

III.D.1.b. Local Fishing Grounds

Pelagic fish that are caught commercially throughout the tropical and subtropical southern and western Pacific include skipjack and yellowfin tuna (Figure III.31), as well as other commercial species, but most are not taken within the territorial waters. Longliners have been observed fishing south of Pago Pago Harbor illegally within territorial waters near the dumpsite, but no enforcement capability is present in American Samoa. Longliners fish well off shore along the south coast when tuna schools move through the area. Wahoo can be canned commercially for use only in American Samoa. The long ranging migratory patterns of these species are impressive; some have been calculated to swim up to 65 mi per day and to cross the Pacific in a matter of two months.

Wass (1983) provided estimates of the quantities of seafood consumed in Samoa from various sources. Of the 2,062,303 kg. (4,537,067 lbs) consumed annually, 1.4% came from the local commercial fleet, 0.7% from powered sportfishing boats, 10.9% from bartering with cannery-bound tuna vessels, and 14.6% from the subsistence/recreational fishery (Table III.12). The importance of the subsistence/recreational fishery is discussed further in Section III.D.5.

III.D.1.c. Nursery Areas and Migratory Patterns

Protection of reproductive areas in shallower waters is critical, because these are the areas where larvae and juveniles find aggregations of food and more turbid waters that protect them from predators. Shallow areas close to habitation can be impacted by wastes and overfishing, but such areas are not characteristic of Tutuila Island. Tuna that spawn in areas of deeper waters are nourished by zooplankton, which feed on phytoplankton supported by nutrients derived from upwelling of the equatorial currents or mixing of water masses (Section III.C.1.a.). Figure III.32.a,b,c (after IATTC, 1979; D.F. Soule, 1981) illustrates the large areas of the world where the highly migratory tuna roam and are fished commercially, as well as the much smaller spawning areas that serve as nursery grounds. It can be seen in that American Samoa lies on the periphery of the spawning areas.

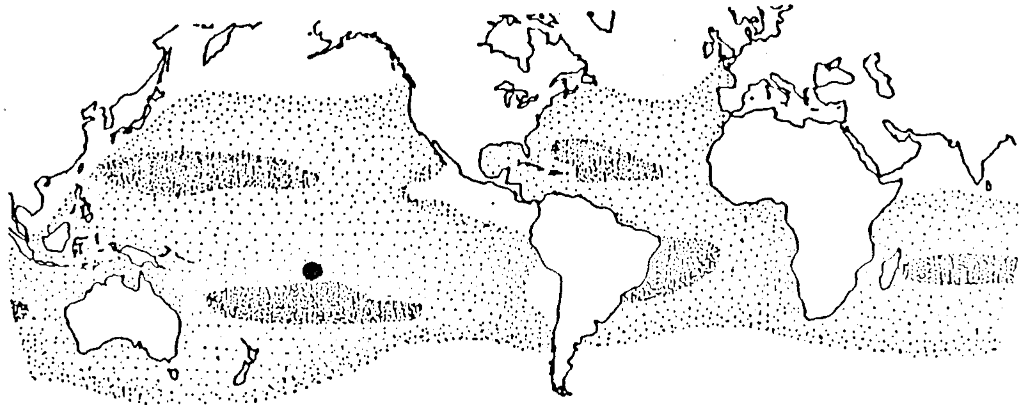
III.D.2. COMMERCIAL SHIPPING

Commercial shipping from American Samoa consists almost entirely of canned tuna and pet food. In the 1980s, the dock facilities for handling cargo containers were significantly expanded along the south side of the inner harbor. Cargo containers form an essential method for import of virtually every necessity or luxury. Small coastal vessels also bring imports from western Pacific ports, along with beer brewed in Western Samoa. When Tutuila was served by large planes of a major international carrier, perishables came from Hawaii or New Zealand and the mainland routinely, but when the major airlines withdrew, local airlines could not

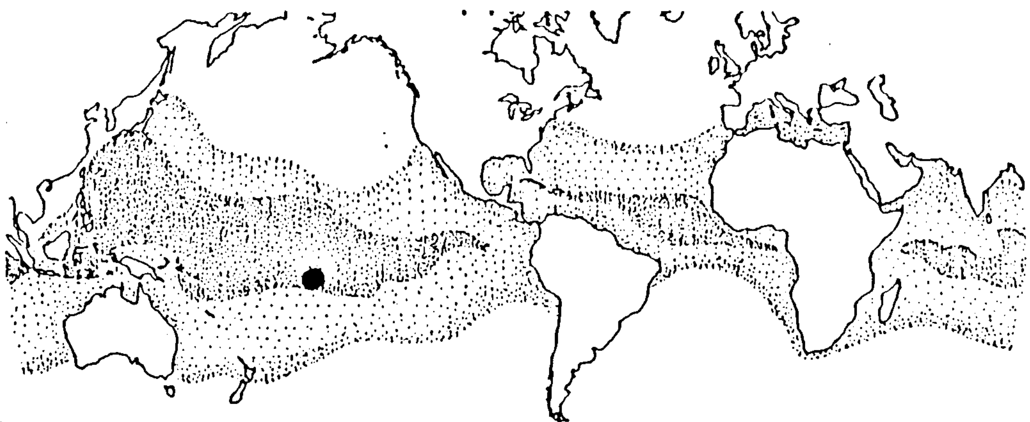
Table III.12. Annual Quantities (kg) and Sources of Seafood Consumed on Tutuila Island (from Wass, 1983). Figures for canned fish have been reduced by 6% for consumption in the Manu'a Islands and by 5% to account for fish taken home by Western Samoans.

Source of Fish	Source of Information	Annual Quantity	Percent of Total
Imports for retail Sale	Customs Office, American Samoa		
Canned		1,200,560	58.2
Frozen		94,187	4.6
Star-Kist Cannery	General Manager, Star-Kist, Samoa		
Canned Wahoo		43,297	2.1
Frozen Miscellaneous		54,976	2.7
Van Camp Company	Ass't. Manager Van Camp, Samoa		
Canned Wahoo and tuna		82,849	4.0
Frozen Miscellaneous Species		17,180	0.8
Barter with Cannery Vessel*	Office of Marine Resources American Samoa	224,245	10.9
Local Commercial Fleet	Office of Marine Resources American Samoa	30,000	1.4
Powered Sportfishing	Office of Marine Resources American Samoa	15,000	0.7
Subsistence/Recreational Fishery	Present Study	300,000	14.6
	TOTAL	2,062,303 kg.	100.0
Per Capita Consumption		67.3 kg.	

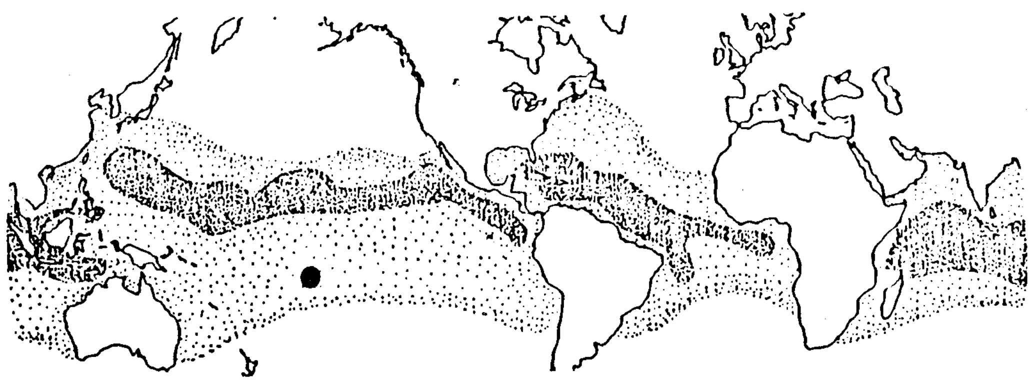
* Several canoes regularly trade island produce and liquor for miscellaneous species of fish (barracuda, wahoo, dolphin, pomfrets, shark-eaten tuna, etc.) with the crews of the longline vessels fishing for the canneries. The fish are sold to markets and restaurants as well as direct to retail customers.



(a)



(b)



(c)

Figures III.32a.b.c. Areas of surface and longline fisheries and spawning of (a) Albacore Tuna (light stippled areas are fishery areas and dark stippled areas are spawning areas; dot is area of American Samoa). b. Areas of surface and longline fisheries and spawning of Skipjack Tuna. c. Areas of surface and longline fisheries and spawning of Yellowfin Tuna (after D.F. Soule, 1981).

handle sufficient cargo, and shortages of produce and staples developed.

III.D.3. MILITARY USAGE

The U.S. Navy maintained a base in Pago Pago from 1900 to 1951, governing the islands as well. During the early years, the deep water port was urgently needed as a coaling station, and during World War II, it served as a fueling station and submarine repair facility. Much of the Navy housing is now in private and ASG hands, although the Federal government maintains housing for people assigned there for the Lyndon B. Johnson Hospital of Tropical Medicine, and by NOAA for the National Weather Service, airport control tower, and miscellaneous advisory or staff positions. The site of the only sizable hotel, the Rainmaker, is on ASG owned fill, which included Goat Island, where the Navy Officers Club was located; the canneries occupy the site of a World War II repair facility on the north side of the harbor. The Coast Guard closed their operations in Pago Pago harbor in the early 1980s, and turned their vessel over to the Port Authority. There is no military presence except for a Coast Guard liaison officer and military recruiters.

III.D.4. OIL AND GAS, MINERAL OR ENERGY DEVELOPMENT

American Samoa is without known deposits of oil and gas or other mineral resources, which is true of oceanic islands that lie outside of continental shelves. Fuel is brought in by tanker and offloaded at docks into storage tanks. At one time, the ASG considered anchoring a supertanker in the harbor for storage, but were dissuaded from such a hazardous procedure, in part by the damage records from the *Sansinena* explosion and fire in Los Angeles Harbor in 1976 (Soule and Oguri, 1978). The narrow harbor, with precipitous mountains surrounding it, would have contained and reflected an explosion with disastrous results. The proposed dumpsite has no non-renewable mineral resource potential.

III.D.5. RECREATIONAL ACTIVITIES

Recreational and domestic (local) commercial fishing occur occasionally in the area of the present dumpsite and the deeper water preferred site. Sport fishing (trolling) takes place in deep waters of the shelf between Pago Pago Harbor and Steps Point. A Fish Aggregation Device (FAD buoy) is maintained south of Steps Point by the ASG Office of Marine and Wildlife Resources with NMFS assistance. Some fishermen and resource specialists would like to have a FAD device at the center of the dumpsite to take advantage of the nutrients in the wastes (R. Wass, F.W.S., pers. comm). The fringing reefs along the south shore are recreational resources for a very limited group, primarily *palagis* (Caucasians) who dive, and surfers. The ASG (1981c) indicates that surfing is an activity which takes place, or might take place, to the east of Breakers Point and to the west of the harbor entrance, from Flower Pot Rock to the entrance of Pala Lagoon. Little surfing was observed, however.

Gleaning (harvesting by hand intertidally) of shellfish on the reef flats during low tides, diving, and fishing with pole and line, rod and reel, netting or seining provides an important protein supplement to the favored local diet, which includes locally raised pork and imported salt beef packed in lard. According to the ASG (1981d), a significant portion of the total catch effort is spent in gleaning: 22% of the total catch was taken by night gleaning and 10% by day gleaning (Table III.13.a). Women and children are often seen on reef flats and rocky intertidal areas picking up shellfish or catching small fish by hand. Fishing was not divided by day and night by ASG (1981d) but pole and line or rod and reel

Table III.13 a. Percent of Subsistence Catch and Time Spent by Method (ASG, 1981d).

	% Fish	% Invertebrates	% Total Catch	Portion of Time Spent%
Day gleaning	4	61	22	23
Night gleaning	6	17	10	11
Pole & line	15	0	9	19
Rod & reel	17	1	12	15
Day diving	21	17	20	17
Night diving	15	4	12	8
Throw netting	14	0	9	6
Seining	8	0	6	1

Table III.13.b. Subsistence and Recreational Catches, in Descending Order (ASG, 1981d).

Fish	Reef Invertebrates
Mackerel	Octopus
Surgeon fish	Snails (marine gastropods)
Jack	Clams
Grouper	Sea anemones
Snapper	Sea cucumbers
Mullet	Sea urchins
Parrot fish	Crabs
Damsel fish	Lobsters

together provided 21% of the total catch. Daytime diving provided 20% of the catch and night diving provided 12%. Throw netting and seining totaled 15% of the catch. Seventy eight percent of the invertebrates (shellfish) were caught by gleaning and the rest by diving. More fish (36%) were caught by diving on the reefs than by pole or rod (32%), and netting or seining counted for 22%. Table III.13.b shows the subsistence gastropods and recreationally produced fish catches, in descending order.

III.D.6. ARCHAEOLOGICAL, HISTORICAL AND CULTURAL RESOURCES

There are no archaeological, historical or cultural sites in the vicinity of any of the ocean dumping sites, nor are there any such coastal sites which could be affected by dumping offshore (ASG, 1981c).

III.D.7. PUBLIC HEALTH AND WELFARE

The public health and welfare is best protected by an ocean dumping site, given the unfortunate circumstances surrounding terrestrial dumping that have been discussed elsewhere in this document (Sections S.b.4, II.B.4).

Soule and Oguri (1983) discussed the potential hazards to public health from ocean dumping. These included the accumulation of lethal hydrogen sulfide gas in the hold of the dump vessel and the question of whether the anaerobic bacterium Clostridium (the cause of the virulently toxic botulism poisoning) could be formed in the waste, as well as the possibility of uptake of heavy metals.

Hydrogen sulfide does form in the hold when wastes are held there for several hours. Vessels carry warning signs of skull and crossbones.

Tests conducted by the National Food Processors Association Laboratories in Berkeley, California showed no trace of Clostridium. The fact that the DAF waste is treated with compressed air would prevent growth of <u>Clostridium</u> since it is an obligate anaerobic species of bacteria (requires absence of oxygen).

The dilution and dispersion of the wastes, and the low specific gravity of the particles which keeps them from reaching the bottom, should prevent bioaccumulation of aluminum and other metals. There is probably a very limited resident population of benthic organisms, given the steepness of the terrain at the present and deeper water preferred dumpsites.

III.E. SUMMARY TABLES FOR THE DISPOSAL SITES

III.E.1. PHYSICAL ENVIRONMENT

Table III.14. Physical Environment of Ocean Disposal Sites

Parameter: / Site:	Present	Deeper Water (Preferred)
Location	$14^{o}22'18'S$ X $170^{o}40'87'W$	$14^{o}24.00'$ S X $170^{o}38.30'W$
Distance from Reefs	2.25 n mi 4.16 km	5.16 n mi 9.55 km
Air Quality	excellent	excellent
Aver. Air Temp. Land	$27.7^{o}C$ $81.86^{o}F$	same
Water Depth	800 fms 1463 m	1502 fms 2746 m
Bottom Geology	basalt *, sediments	basalt *
Slope Seaward	gradual, irregular	steep
Light Penetration	85-100% surf., <15-25 m	similar *
Aver. Water Temp., Surf.	$28.2^{o}C$ $82.76^{o}F$	similar *
Temp. Range, surf. (Field Reports)	$27.9-30.8^{o}C$ $82.2-87.4^{o}F$	no data similar *
Salinity (ppth) Range (Field Repts)	34.1-37.1 var.± 1.5 per day	no data similar *
Dissolved Oxygen mg/l (Field Repts.)	6.02-7.7 similar *	no data similar *

similar * means that, on the basis of published and unpublished information, characteristics are expected to be similar to those found at the preferred site.

III.E.2. BIOLOGICAL ENVIRONMENT

Table III.15. Biological Environment of Ocean Disposal Sites

Site: / Parameter:	Present	Deeper Water (Preferred)
Coral Reefs:		
on site	none	none
in plume trajectory	no (present quantities)	no
Plankton	few *	few *
Benthic Algae	none	none
Invertebrates:		
benthic	few *	few *
pelagic	few *	few *
Fish:		
reef assoc.	none	none
demersal	few *	few *
pelagic	few schools	few schools
Coastal Birds	few	few
Turtles	rare	rare
Marine Mammals	few whales possible	few whales possible

* means no data are available, but answers can be extrapolated from published and unpublished information on similar areas.

III.E.3. SOCIOECONOMIC ENVIRONMENT

Table III.16. Socioeconomic Environment of the Disposal Sites

Site: / Parameter:	Present	Deeper Water (Preferred)
Commercial Fishery	no activity	occasional activity
Tuna Processors	alternative site	preferred site
Commercial Shipping	none	none
Military Usage	none	none
Oil and Gas Development Present	none	none
Non-renewable Resources	none	none
Recreational Activities	rare	none
Archaeological Resources	none	none
Historical Resources	none	none
Cultural Resources	none	none
Public Health and Welfare	no exposure to waste	no exposure to waste

CHAPTER IV. ENVIRONMENTAL CONSEQUENCES

IV.A. INTRODUCTION

This chapter assesses potential impacts of the proposed project alternatives on the physical, biological, and socioeconomic environmental segments discussed in Chapter III. Waste dumped at any site designated is expected to have some impacts on one or more of these environments, even though they may be minimal. It is the purpose of this EIS to determine potential adverse impacts on the site and to evaluate the impacts on areas outside the site related to human health and the marine environment.

Four classes of impact will be used to categorize the effects of the two ocean dumping alternatives as compared with the no action alternative. These are as follows:

Class I. Unavoidable significant adverse impacts that cannot be mitigated to the point of non-significance. This includes those impacts that would result in immediate irreversible change, or in chronic degradation to the point of irreversible change, in the physical, biological or socioeconomic environment.

Class II. Significant adverse impacts that can be mitigated and reduced to Class III impacts. These impacts are similar in severity to Class I impacts, but the severity can be reduced or avoided by mitigation measures that are discussed under each alternative.

Class III. Adverse impacts that are insignificant, or no effect is anticipated. These impacts and effects require no mitigation.

Class IV. Beneficial Impacts. These impacts would result in improved conditions relative to baseline conditions.

The term "significant" is used in this chapter to characterize the magnitude of the potential impact. For the purposes of this EIS, a significant impact is a substantial or potentially substantial change to resources in the vicinity of the dumpsite or adjacent areas.

In the following discussions, criteria used to distinguish between significant and insignificant impacts are provided. Distinctions are made in scope of impacts, as those which have on-site, local, or regional significance, and in the term of impacts, either short term or long term. Mitigation measures are discussed where appropriate. Examples of impacts are given below.

Class I impacts, if present in American Samoa, would include effects that could not be mitigated. In the case of ocean disposal, effects might be pollution of shoreline, destruction or degradation of reef habitats and/or reef fauna, or reduction in populations of benthic or pelagic invertebrates, demersal or pelagic fish, marine mammals or coastal birds.

Class II impacts, if present in American Samoa, are those such as prolonged low dissolved oxygen, that might occur if dumping practices were not designed for mitigation. This has already been done by enlarging the disposal site and moving it farther from shore, and by mixing of the wastes as they are pumped from the vessel while it is in motion.

Class III impacts are those that are not significant, including those that are temporary, such as turbidity. The effects are transitory, and would not interfere with the growth of marine algae or stony corals, which do not occur at the dumpsites. Natural ocean phenomena of turbulent mixing, diffusion and dilution, as well as biological metabolism by micro-heterotrophs and phytoplankton, cause the plume to disappear.

Class IV impacts might include the addition of nutrients, in quantities that can be assimilated, in a nutrient-poor environment.

Criteria for evaluating Class I or Class II adverse impacts on the physical environment are:

1) The likelihood of a relatively large amount of change from predisposal conditions, as indicated by analagous situations or previous studies.
2) The persistence of adverse impacts for a long enough time to affect receiving waters or benthic environments measurably.
3) The relative volume of water or area of the sea floor adversely affected, which determines whether the effects are restricted to the site, local or regional area.

No Class I or Class II impacts have been identified with ocean disposal of fish cannery waste at either of the alternative sites proposed in this EIS.

IV.B. PRESENT OCEAN DISPOSAL SITE

The present site, which is in an area used under interim and research permits for disposal of fish cannery wastes since 1980, is located about 2.25 n mi (4.17 km) from the nearest shore. The site was described in detail in Sections II.A.1 and III.A.1, and the salient features are summarized in Table II.1.

IV.B.1. EFFECTS OF THE PRESENT DUMPSITE ON THE PHYSICAL ENVIRONMENT

IV.B.1.a. Meteorology and Air Quality

The air quality off American Samoa is excellent, with winds most of the time. The only impact on air quality from the ocean disposal project is from vessel emissions in transit to and from the site and in circling while dumping. These are Class III impacts, for which no mitigation is needed.

IV.B.1.b. Water Quality

Physical effects of dumping fish cannery wastes include a transitory increase in turbidity in the upper 10 to 20 m of the water column for up to one hour. There was a very transitory depression of dissolved oxygen immediately in the wake of the dump vessel, but it did not drop below water quality standards during most tests, and the duration was under four hours.

No changes in temperature, or salinity were observed during field monitoring and pH fluctuations were transitory. There is a temporary presence of a visible sheen or slick at the surface which may persist for up to four hours, but it is below the limits of detection chemically at that time.

There are also temporary increases in ammonia-N and oil and grease. Aluminum and other trace metals present in the sludge (See Section III.A.) tend to complex with fine suspended particles and be dispersed. Pesticides have not generally been found in the wastes sampled.

IV.B.1.c. Regional Geology

There are no impacts on the geology of the dumpsite or on the region, since the wastes do not reach the benthos in waters 910 fms (1664 m) deep. IV.B.2. EFFECTS ON THE BIOLOGICAL ENVIRONMENT

Potential effects on marine communities for each alternative were examined to evaluate the direct or indirect impacts on marine communities resulting from ocean disposal of fish cannery wastes.

Ocean dumping, which has been practiced since 1980 off American Samoa, has not had any Class I or Class II long-term, adverse effects on the local or regional biological environment, and may have had beneficial Class IV effects.

Criteria used in this section to assign significance of potential impacts are as follows:

1) Significant on-site only, if biological impacts are expected to occur within the 0.75 n mi radius of the center of the present dumpsite, or within a 1.75 n mi radius of the deeper water site.

2) Locally significant if the impacts contribute substantially to a measurable change in species composition or distribution in a particular habitat located within 1 n mi (1.8 km) outside the project site.

3) Regionally significant if impacts are judged to cause or substantially contribute to measurable changes in the function of any habitat of special importance, or adverse changes in the population of any species of recognized regulatory, commercial, scientific or recreational importance beyond the local vicinity of the dumpsite.

IV.B.2.a. Plankton

Ocean dumping off American Samoa may have caused a slight increase in bacterioplankton (microheterotrophs) and possibly in phytoplankton. Since tropical oceanic waters are depauperate, based on the observed clarity and the low numbers of fish, such an increase might enhance the numbers of zooplankton and hence of forage fish around Tutuila Island. These in turn might attract more pelagic fish and invertebrates to either the present site or the deeper water site. Such an impact would be a Class IV beneficial impact.

Unlike conditions in some mainland coastal waters, any increase in microheterotrophs or phytoplankton caused by this project would not bring about even a mild, Class III eutrophication. If the slight change in color of the water from deep oceanic blue to lighter blue on the Forel Ule color scale can be interpreted as an increase in bacterioplankton or phytoplankton, the area of change extends beyond the site toward the nearshore waters. An increase in microheterotrophs and/or phytoplankton would be beneficial to the zooplankton in the area, by providing the usually low numbers of microorganisms and plankton with increased nutritional resources.

IV.B.2.b. Coral Reefs

There are no stony corals (reef corals) at the present site, but soft corals may occur on the bottom if there is a firm substrate and adequate current. The coral fringing and patch reefs in shallow water can benefit from a modest increase in levels of nutrients in the water column in the general area, but could not tolerate eutrophic conditions nor increased turbidity. Turbidity from the dumpsite does not normally reach the reefs, although turbidity associated with extensive shore runoff, filling, and coastal erosion from wave action has reduced the extent of live corals. Some reports have indicated that wastes reach the reefs but no physical evidence has been collected nor have dates, times and observations of wind and current been available to evaluate conditions under which alleged sightings occurred.

IV.B.2.c. Benthic Infauna

No impacts were expected on the benthic infauna because of the depth of the water and the fact that the plume is generally limited to the upper 20 m of water by the specific gravity of the waste. Also, the DAF sludge is injected with air under pressure during treatment. This helps to form the coaguluum and make it float to the top of the sludge tanks; thus it continues to float at the dumpsite until dispersed or biodegraded. No benthic sampling has been undertaken because of the depth, the slope, and the lack of adequate sampling vessels and gear in American Samoa.

IV.B.2.d. Benthic Epifauna

No impacts were expected on benthic epifauna which may be present at the site, such as the soft corals, crustaceans or molluscs. If some small quantities of nutrient particles were to reach that depth, they would be immediately assimilated in that nutrient-poor environment.

IV.B.2.e. Demersal Fish

No impacts were expected on demersal fish, since no wastes reach the benthos where demersal fish generally feed. Some demersal fish will feed in the water column, but no trawls have been carried out in the area, due in part to the lack of equipment and to the expected small numbers of such fish. The nutrient-poor benthos would not support an extensive fauna which is favored by demersal species.

IV.B.2.f. Pelagic Fish

An increase in plankton resulting from ocean dumping of fish cannery wastes might increase the numbers of small pelagic forage fish, crustaceans or molluscs in the area, providing more food for the tuna species and game fish that might pass through the offshore waters (See Section III.C.3.d.). The highly migratory fish roam the oceans and there are no species with limited habitats which might be affected by the wastes at either the present or the deeper water site.

IV.B.2.g. Pelagic Invertebrates

Pelagic squid, nautiloids and crustaceans are predators in Samoa waters that are in turn fed upon by tuna and game fish. Deep waters off the south side of Tutuila Island are not generally good fishing areas, and marine mammals which breed in the shallower waters do not often frequent the dumpsite area. Therefore, it may be assumed that the pelagic invertebrates are not plentiful there or are inaccessible. The nautiloids apparently favor somewhat deeper waters in the daytime, and come to Taema Banks to feed at night. Any increase in small forage fish and invertebrates which could be due to the increased nutrients from the cannery wastes would have a beneficial effect (Class IV) on pelagic invertebrates.

IV.B.2.h. Coastal Birds

Terns are almost the only birds seen in the area of the present site diving for food when small schools of juvenile tuna were observed during monitoring. Marine oriented birds would benefit from an increase in small forage fish and invertebrates, but most coastal birds do not venture out to sea to feed as far as the dumpsites. Class IV benefits would accrue from any potential increase in forage species in the nearshore area.

IV.B.2.i. Marine Mammals

Marine mammals are uncommon in the areas of the dumpsites on the south side of Tutuila Island. The humpback whales tend to congregate to the west and around Western Samoa, where there is more shelf area used during mating and reproduction. Migrating whales would usually pass farther offshore, but whales have occasionally entered outer Pago Pago Harbor. Whales may avoid the plume or swim through it; its small size would be of no concern to these large animals, and the dump vessel would be avoided easily. The disposal site is not in or near the breeding grounds (See Section III.C.3.f.). Impacts would probably be Class III on the humpback whales.

IV.B.2.j. Threatened and Endangered Species

The humpback whale is an endangered species, and the population that reproduces in the southern tropical Pacific islands and migrates from

Antarctica is especially endangered from decimation by whaling in past years. Humpbacks are baleen whales, feeding by straining out tiny crustaceans ("krill") such as copepods, euphausiids, and amphipods. According to NMFS these whales do not feed when they are in the general area, and they do not seem to congregate south of Tutuila Island.

There are 5 species of endangered turtles (Section III.C.3.g) which might migrate through the general area, but have very rarely been seen in American Samoa. Illegal capture of turtles has been rumored near Fagatele Bay, but cannot be confirmed. There would be no impact on migration or on reproduction if turtles did venture to cross the dumpsites, and thus the impact is rated as Class III.

IV.B.2.k. Marine Sanctuaries, Areas of Special Biological Significance

The Fagatele Bay National Marine Sanctuary is about 5 n mi (9.25 km) west of the present dumpsite and about 7 n mi (12.9 km) west of the deeper water site. The longshore current flows southwest out to sea off Steps Point, which would deflect any remnants of a plume in the unlikely event that it would move that far from the present site. At that distance the wastes would be below the limits of detection. The illegal dynamiting and cloroxing to harvest fish and squid in Fagatele Bay, where there is no enforcement available, are the chief threats to its environment. The impact of the dumpsites on the sanctuary are Class III, no impact. No areas of special biological significance (ASBS) have been designated.

Pala Lagoon is an ASG area of biological significance. It lies north of the airport runways which partially filled the lagoon leaving an eastern opening Avatele Passage. If the waste slick were carried to shore when the longshore current was absent or reversed, it might reach the lagoon during incoming tide. The lagoon is already impacted by urban activities and excess nutrients would be harmful.

IV.B.3. EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

Potential socioeconomic impacts of designation of an ocean disposal site are examined in this section for all known resources that have been identified in Section III.B. and listed in Table IV.1. This procedure gives the full benefit of consideration to all factors in the NEPA planning and review process. Mitigation measures are proposed, if needed, and net beneficial impacts are considered.

Criteria developed for this section are as follows:

1) The potential for changes sufficient to affect the short- or long-term conditions of economic stability of the American Samoans and other Pacific island people in relation to the principal private industry.

2) The initiating of changes sufficient to affect the nutritional intake of the population, whether related to commercial fisheries products, subsistence fishing and gleaning, or recreational activities.

IV.B.3.a. Commercial Fishing

There are no Class I, II, or III adverse effects from ocean disposal at either site on commercial fishing in the area on the south side of Tutuila Island. Tuna for the canneries are primarily caught farther west in the tropical Pacific, and the small amount of longliner fishing seaward of the sites, outside territorial waters, would not be affected by dumping or the waste plume. Fish stocks for the local commercial fishery might be minimally improved (Class IV) by the nutrient content of the wastes if the plankton stock of the area is improved.

There is no hazard to, or impact on, the fishing fleet due to disposal, since the area of the dumpsites is generally not fished commercially, and the vessels would not normally transit the area in approaching the harbor.

IV.B.3.b. Commercial Shipping

There is minimal vessel traffic of all sorts in American Samoa, and the dumpsites are not in the traffic patterns usually used by vessels entering or leaving the harbor. Visibility is generally quite adequate for normal observation and visual navigation.

There is no hazard to, or impact on, commercial shipping, because access to the harbor is generally by traveling from the east or west along Tutuila Island near the 120 fm contour to reach Pago Pago Harbor. Thus, the dumping operation would not interfere with vessel traffic, safety or port access. Traffic of cargo vessels originates primarily from the mainland or Hawaii to the north and northeast, while passenger ferries and interisland cargo vessels arrive from Western Samoa to the west northwest.

IV.B.3.c. Oil and Gas Development

There is no oil and gas development in the mid-Pacific islands, including American Samoa, since those resources are limited to continental shelf regions.

IV.B.3.d. Military Usage

There is no present military use of the waters off American Samoa. The Naval Base in Pago Pago Harbor was closed in 1951, and the Coast Guard no longer maintains a vessel there. Should this situation change, ocean dumping would not interfere with vessel traffic or access.

IV.B..e. Sport Fishing

Sport fishing does not specifically take place in the area of the dumpsites. The potential beneficial effect (Class IV) would derive from the additional nutrients released at the present site if increases in plankton, and thus in small forage fish, closer to shore result in attracting game fish to the area.

IV.B.3.f. Other Recreational Activities

There are no other recreational activities taking place in the vicinity of either dumpsite. If nutrients dumped at the present site result in increased plankton, forage fish, reef organisms or benthic molluscs, the effects would be beneficial, Class IV impacts.

IV.B.3.g. Subsistence Fishing

There is virtually no subsistence fishing in the area of the dumpsites, since small boat fishing usually takes place nearer to shore. Rarely, a skiff will be seen handlining for juvenile tuna near the present dumpsite, but dumping does not interfere with that. If nutrients from the present site have increased the plankton and nearshore fishery, dumping would have had a beneficial effect, a Class IV impact, on subsistence fishing.

IV.B.3.h. Cultural Uses

There are no cultural or historical uses of the present or deep water sites.

IV.B.3.i. Public Health and Welfare

Public health, welfare and safety are best protected by ocean dumping offshore. Either of the sites discussed protects those concerns, and is given a Class IV impact evaluation for that reason.

IV.C. DEEPER WATER SITE: THE PREFERRED SITE

The deeper water site, also described in Sections II.A.1 and III.A.1, is about 5.45 n mi (10.08 km) from shore, and has a depth of 1502 fms (2746 m). The larger diameter of 3.0 n mi (5.56 km) proposed for the site would overlap the periphery to the southeast margin of the present site making the existing baseline data from the present site applicable to the deeper site.

IV.C.1. EFFECTS ON THE PHYSICAL ENVIRONMENT

The physical environment of the deeper water site is similar to that of the present site except for the increase of about 600 fms (1096.8 m) in depth, and the slope of the bottom is probably more steep. The same criteria use to evaluate the present site (Section IV.B.) are used in this evaluation. Impacts on the deeper water site are summarized in Table IV.2.

IV.C.1.a. Air Quality

The impacts on air quality are Class III, insignificant, the same as for the present site. The distance traveled by the dump vessel is longer, but the change in emissions would be negligible, and of minor transitory impact.

IV.C.1.b. Water Quality

The effects on water quality at the site would be similar to those at the present site, Class III. The larger diameter of the deeper water site would provide for greater assurance that water quality would reach ambient levels at the northwest periphery of the site, which is 0.83 n mi beyond ASG waters.

IV.C.1.c. Geology

There are no impacts on the geology of the site or region.

IV.C.2. EFFECTS ON THE BIOLOGICAL ENVIRONMENT

The impacts from use of the deeper water site are similar to those at the present site for the most part. The same criteria are used to evaluate the deeper water site as are used in Section IV.B. for the present site. There may be fewer potentially beneficial effects at the deeper water site, however (Table IV.2) because of the greater distance from shore and the deeper water but the additional protection provided to the reefs is of paramount importance.

IV.C.2.a. Plankton

The plankton is depauperate in tropical oceanic waters, and at this distance from shore there is less possibility that nutrients will be retained in the area to increase the plankton density as they might be in nearshore waters. There is no adverse impact of the wastes on plankton in the site area.

IV.C.2.b. Coral Reefs

There is no impact on coral reefs from the deeper water site.

IV.C.2.c. Benthic Infauna and Epifauna

There are no impacts on the benthic fauna because the depths are too great for the plume to reach the bottom and the slopes are too steep to accumulate sediment in support of a benthic infauna. Epifauna, if present would also not be reached by the wastes.

IV.C.2.d. Demersal Fish

There is no impact on demersal fish because the plume is too near the surface to affect them.

IV.C.2.e. Pelagic Fish

There are no impacts on pelagic fish expected. There is a slight possibility that the plume might attract forage fish on which larger fish could feed.

IV.C.2.f. Pelagic Invertebrates

The are no impacts on pelagic invertebrates expected. Squid and nautiloids may pass through the general area, but are not likely to feed on the wastes or to be affected by them. Small crustaceans might feed on the wastes, but oceanographic mechanisms to concentrate food particles or the crustaceans which would attract predators seem to be lacking.

IV.C.2.g. Coastal Birds

No impacts on coastal birds are expected. Most of the birds stay closer to shore, although a few terns have been seen in the general area. Cannery wastes would not affect the birds. If forage fish are feeding on the wastes, birds would be attracted to feed.

IV.C.2.h. Marine Mammals

No adverse or beneficial impacts on marine mammals are expected from use of the deeper water site. Occasionally a few whales are sighted south of Tutuila Island, but the waste plume or the dump vessel would not disturb them should whales enter the area. They can easily avoid either the vessel or the plume if they so choose.

IV.C.2.i. Threatened or Endangered Species

No impacts are expected on the endangered humpback whales or on five species of endangered turtles that might pass through the general area. All of these species migrate over great distances and the dumpsites are not on regularly frequented routes. The cannery waste would not be harmful to them in swimming through it.

IV.C.2.j. Marine Sanctuaries or Areas of Special Biological Significance

The deeper water preferred site is 7.0 n m from Fagatele Bay, 3.25 n mi farther than the present site, and no impacts on Fagatele Bay have occurred under past and present ocean dumping. The site is also 2.9 n mi farther from fringing reefs and Pala Lagoon. Therefore, no impacts are expected from the deeper water site.

IV.C.3. EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

IV.C.3.a. Commercial Fishing

There are beneficial financial effects for the international fishing fleet, and beneficial financial and legal effects for the fish canneries in having an environmentally acceptable permanent ocean dumpsite.

There are no adverse and probably no beneficial effects on the commercial fish stocks from disposal at the deeper water site. Neither site offers any impact on fleet safety.

IV.C.3.b. Commercial Shipping

There are no impacts on commercial shipping at the site, since it is not in the generally used traffic patterns.

IV.C.3.c. Oil and Gas Development

There is no potential for oil and gas development off American Samoa, because those resources are generally limited to continental shelves.

IV.C.3.d. Military Usage

The are no impacts on military usage because there is no military presence. Should the need arise to accommodate naval vessels, the harbor is able to do so, and waste dumping would not interfere.

IV.C.3.e. Sport Fishing

There is probably no impact on sport fishing from dumping at the deeper water site because of the greater dispersion of the nutrients expected in the open season.

IV.C.3.f. Other Recreational Activities

There are no other recreational activities at the deeper water site.

IV.C.3.g. Cultural Uses

There are no cultural resources or uses at the deeper water site.

IV.C.3.h. Public Health and Welfare

The use of either the present site or the deep water site is beneficial to public health and welfare because it protects the public from the hazards of terrestrial disposal.

IV.C.4. CONCLUSIONS ON EVALUATING IMPACTS

IV.C.4.a. Physical Environment

All of the effects discussed above for the preferred ocean disposal site are Class III impacts that are limited in term and scope. The waste materials are mixed, diffused, diluted and dispersed to insignificant levels in the water column, and disappear well before they could approach critical habitats or shore. Results of field monitoring are discussed in Appendix A herein, and in Soule and Oguri (1983a). Results of chemical analyses of the wastes are included in Section III.A. Appendix B illustrates numerical model calculations of the plume as it reaches the 1:250,000 dilution, or 0.0004% level calculated as the Limiting Permissible Concentration by means of bioassays.

IV.C.4.b. Impacts on the Biological Environment

There are no Class I or Class II adverse impacts from ocean disposal of fish cannery wastes at the preferred ocean dumpsite discussed in this EIS, under the conditions of disposal with adequate mixing as presently practiced. There may have been beneficial effects, Class IV, on nearshore fisheries resources from the present dumpsite if the nutrients entered the food chain in the area between the site and the nearshore waters. Class IV benefits are less likely at the preferred site due to the greater distance from shore and different current patterns, but protection of the reefs by the greater distance is of paramount concern.

IV.C.4.c. Impacts on the Socioeconomic Environment

There are no Class I or II impacts on socioeconomics with the use of either ocean site. Class III impacts are listed as no impacts (0) or as insignificant (X), since they do not interfere with the conditions in any of the categories listed in Table IV.1. Potential beneficial impacts, Class IV, are slightly more likely to develop for sport fisheries and recreational uses from disposal at the present site than at the deeper water site. Costs of transporting the wastes to the deeper water site would be minimally higher than at the present site. Disposal at either site is beneficial to the public by protecting their terrestrial resources and their safety.

IV.C.5. SITE SELECTION

IV.C.5.a. Choices

The choice between the two sites was made by EPA with input from federal and ASG Agencies, scientists and the public, by evaluating the following questions:

1) Although the present site appears to have functioned satisfactorily, would the deeper water site provide a greater margin of safety from encroaching on reef habitats under adverse wind, wave and current conditions since it is farther from shore?

2) Would the larger diameter of the deeper water site provide for a more adequate mixing zone? Even though the site is outside territorial waters, it is desirable to have the plume reach ambient conditions and dissipate before reaching ASG waters.

3) Would these additional safety factors mitigate the loss of feasibility for intensive field monitoring because of the greater distance from shore, the roughness of the waters, and the consequent difficulties and hazards in surveillance by small boat? Monitoring of the wastes by sampling the load on

board and taking grab samples from the dump vessel before and after disposal would then replace the extensive field surveys performed under the research permits.

4) Since no Class I or Class II impacts have been identified with either site, can small vessel field monitoring be dispensed with entirely, given the data base that has been obtained and the lack of Class I or Class II adverse impacts on the biological environment?

5) Would possible beneficial effects on the nutrients of the nearshore habitats be lost by use of the deeper water site?

IV.C.5.b. Unavoidable Adverse Environmental Effects

There are no unavoidable adverse effects in ocean disposal of permitted quantities of waste at the deeper water sites, so long as the materials are dumped on the identified site. Even if trajectories of drogues or current meter readings indicate a northward direction of flow under certain wind and weather conditions, the evidence indicates that the waste material is diluted or diffused below detectable levels well before it would reach territorial waters, and would not approach reef or shoreline habitats (See Appendix B).

IV.C.5.c. Mitigation Measures

The detailed Monitoring Plan and Site Management Program is presented in Appendix C. At the present time, there is no indication that mitigation measures other than those in effect are necessary. The canners have equipped the dump vessel with Radar to assist in determining that dumping is taking place at the stipulated site. The vessel captain is required to file reports of the quantities dumped according to date and time to the ASG, the Coast Guard and EPA Region 9. A monitoring program less reliant on electronic devices for field monitoring and intensive laboratory analyses than that in force during the research permits would suffice to insure proper disposal procedures.

IV.D. NO ACTION ALTERNATIVE

The same criteria and classifications used to discuss the ocean dumping sites (Sections IV.B. and IV.C.) will be used in this section. The No Action alternative would be not to designate an ocean dumpsite. This would give the processors three options:

Option 1. Dumping without a permit, or a designated dumpsite, which is subject to civil and criminal penalties.

Option 2. Dump on land in violation of court orders, Federal regulations and ASG regulations.

Option 3. Discontinue use of DAF equipment and release the liquid wastes into the harbor, in violation of NPDES permits.

Option 4. Close the canneries.

IV.D.1. EFFECTS ON THE PHYSICAL ENVIRONMENT

Effects of Option 1 on the physical environment would be the same (Table IV.1.) as those now being incurred under ocean dumping, provided that the canners continued to dump in the same or a similar place, and in the same manner.

As discussed in Section II.A.2, the effects of Option 2 on the physical environment would be Class I if the water table were to become contaminated. Terrestrial dumping has been prohibited by the ASG and this is not a viable option.

Option 3 would also have Class I impacts on the harbor which would include greatly increased turbidity, reduction in dissolved oxygen, production of sulfide, and extensive odor emission, all of which would violate conditions of the NPDES permits. The impacts on the physical environment at the dumpsite would not be changed or improved, since dumping has only a Class III impact. Impacts on the harbor would, however, be Class I, seriously damaging water quality without the possibility of adequate mitigation measures.

IV.D.2. EFFECTS ON THE BIOLOGICAL ENVIRONMENT

Under the Options listed in Section IV.D, above, continuation of dumping without a permit or designated dumpsite would continue the existing biological impacts, which are Class III or Class IV impacts, provided that the canners continued to dump offshore as they presently operate under permit. Option 2, increasing discharge into the harbor, would have Class I impacts of major proportions on the harbor biota, probably killing fish and shellfish throughout the inner and outer harbors, and killing corals in the outer harbor and at Taema Bank. The sparse corals present now would probably never recover from such a continuing environmental insult.

Under Option 4, closing the canneries would probably result in a short-term improvement in the harbor, followed over a longer term by a decrease in biota due to reduction in nutrients in the harbor, and probably to a reduction in biota outside the harbor. This might be viewed as a return to more "natural" conditions ecologically were it not for other urban impacts such and storm drain runoff that would continue.

IV.D.3. EFFECTS ON THE SOCIOECONOMIC ENVIRONMENT

The socioeconomic impacts of dumping without a permit under Option 1 would be the liability for severe penalties for violation of laws and regulations (Class I). This could also result in enforced closure, rather than voluntary closure, Option 4.

The socioeconomic impacts of Option 2 would be similar, since it is illegal also (Class I). Closure of the canneries would destroy that sector of the economy that supports about 40% of those available for employment in American Samoa, either as primary or secondary level employees (Section III.D). The American Samoa Government is the largest employer, and it is heavily subsidized by Federal grants and allocations. Loss of local taxes would undermine ASG employment and thrust the entire area into dependence on Federal welfare programs.

The impacts on the industry would also be Class I if they were forced to close. The Samoa canneries are second only to those in Puerto Rico in size and serve a fishing fleet that covers much of the western Pacific. Relocation would mean abandoning investments in plant facilities and experienced work force. While the canners would probably be welcomed in other Pacific islands, it would take several years to become operational elsewhere, resulting in an irretrievable loss of income.

Tables IV.1-IV.3 provide summaries of the classes, areas and time spans (terms) of impacts of dumping cannery wastes. The important factor to note is that there are no Class I or Class II impacts from ocean dumping under permit conditions. There are transitory Class III impacts. The potential for beneficial effects due to added nutrients may or may not be as great at the preferred site, given the added distance from shore and water depth. Detailed investigations of the food web and circulation patterns would be needed to determine whether beneficial effects accrue at either site. Protection of the reefs by moving the preferred site is of far greater importance in site selection than the potential for bioenhancement.

Table IV.1. Summary of Impacts and Mitigation Measures for the Present Site (Refer to Page IV-1 for explanation of Classes).

Description	Class I	Class II	Class III	Class IV	Scope(1) S	Scope(1) L	Scope(1) R	Term(2) S	Term(2) E	Potential Mitigation Measures
PHYSICAL ENVIRONMENT										No mitigation
Air Quality			X				X	X		measures
Water Quality										proposed
turbidity,			X			X		X		because
dissolved oxygen,			X		X			X		effects are
trace metals			X		X			X		short-term.
DDTs, PCBs,			0							
oils & greases			X					X		
Geology										
sediment grain size			0							
sediment quality			0							
BIOLOGICAL ENVIRONMENT										
Plankton				X			X		X	
Coral Reefs			0							
Benthic Infauna			0							
Benthic Epifauna			0							
Demersal Fish			0							
Pelagic Fish				X			X		X	
Pelagic Inverts				X			X		X	
Coastal Birds				X			X		X	
Marine Mammals			0							
Threatened and Endangered Species			0							
Marine Sanctuaries, Areas of Special Biological Significance			0							

X = impact - 0 = no impact

(1) = Scope Definitions
S = site, 1.5 n mi radius.
L = local, up to 1 n mi outside of site.
R = region, beyond local vicinity of dumpsite.

(2) = Term

S = short, less than or equal to 4 hours.
E = extended, greater than 4 hours.

(Continued)

Table IV.1. (cont'd). Summary of Impacts and Mitigation Measures for the Present Site (Refer to page IV-1 for explanation of Classes).

Description	Class I	Class II	Class III	Class IV	Scope(1) S	Scope(1) L	Scope(1) R	Term(2) S	Term(2) E	Potential Mitigation Measures
SOCIOECONOMIC ENVIRONMENT										No mitigation measures are needed
Commercial Fishing										
fish canneries				X			X		X	
fish stocks				X			X		X	
fishing fleet safety			O							
Commercial Shipping			O							
safety			O							
port access			O							
Oil & Gas Development			O							
Military Usage			O							
traffic interference			O							
naval ship access			O							
Sport Fishing				X			X		X	
Other Recreational Activities				X			X		X	
Subsistance Fishing				X			X		X	
Cultural Uses			O							
Public Health and Welfare										
health				X			X		X	
safety				X			X		X	

X = impact
O = No impact

(1) = Scope Definitions
S = site, 1.5 n mi radius.
L = local, up to 1 n mi outside of site.
R = region, beyond local vicinity of dumpsite.

(2) = Term
S = short, less than or equal to 4 hours.
E = extended, greater than 4 hours.

Table IV.2. Summary of Impacts and Mitigation Measures for the Deeper Water Preferred Site (Refer to page IV-1 for explanation of Classes).

Description	Impacts: Class I	Class II	Class III	Class IV	Scope(1) S	Scope(1) L	Scope(1) R	Term(2) S	Term(2) E	Potential Mitigation Measures
PHYSICAL ENVIRONMENT										No mitigation measures proposed because effects are short-term
Air Quality			X				X	X		
Water Quality										
turbidity,			X			X		X		
dissolved oxygen,			X		X			X		
trace metals			X		X			X		
DDTs, PCBs,			O							
oils & greases			X		X			X		
Geology										
sediment grain size			O							
sediment quality			O							
BIOLOGICAL ENVIRONMENT										
Plankton				X			X		X	
Coral reefs			O							
Benthic Infauna			O							
Benthic Epifauna			O							
Demersal Fish			O							
Pelagic Fish				X			X		X	
Pelagic Inverts.				X			X		X	
Coastal Birds				X			X		X	
Marine Mammals			O							
Threatened and Endangered Species			O							
Marine Sanctuaries, Areas of Special Biological Significance			O							

X = impact - O = no impact

(1) = Scope Definitions
S = site, 1.5 n mi radius.
L = local, up to 1 n mi outside of site.
R = region, beyond local vicinity of dumpsite.

(2) = Term
S = short, less than or equal to 4 hours.

E = extended, greater than 4 hours.

(Continued)

Table IV.2. (cont'd). Summary of Impacts and Mitigation Measures for the Deeper Water Alternative (Refer to page IV-1 for explanation of Classes).

Description	Impacts: Class I	II	III	IV	Scope(1) S	L	R	Term(2) S	E	Potential Mitigation Measures
SOCIOECONOMIC ENVIRONMENT										No mitigation measures proposed because effects are short-term.
Commercial Fishing										
fish canneries				X			X		X	
fish stocks			O							
fishing fleet safety			O							
Commercial Shipping										
safety			O							
port access			O							
Oil & Gas Development			O							
Military Usage			O							
traffic interference			O							
naval ship access			O							
Sport Fishing				X			X		X	
Other Recreational Activities			O	X			X		X	
Subsistence Fishing				X			X		X	
Cultural Uses			O							
Public Health and Welfare										
health				X			X		X	
safety				X			X		X	

X = impact - O = no impact

(1) = Scope Definitions
S = site, 1.5 n mi radius.
L = local, up to 1 n mi outside of site.
R = region, beyond local vicinity of dumpsite.

(2) = Term
S = short, less than or equal to 4 hours.
E = extended, greater than 4 hours.

Table IV.3. Summary of Impacts and Mitigation Measures for the No Action Alternative (Refer to page IV-1 for explanation of Classes).

Description	Impacts: Class I	Class II	Class III	Class IV	Scope(1) S	Scope(1) L	Scope(1) R	Term(2) S	Term(2) E	Potential Mitigation Measures
PHYSICAL ENVIRONMENT	X						X		X	
BIOLOGICAL ENVIRONMENT	X						X		X	
SOCIOECONOMIC ENVIRONMENT										
Commercial										
Fishing	X									
Canneries	X						X		X	
Shipping	X						X		X	
Military Use			O							
Public Health, and Welfare										
health	X						X		X	
safety	X						X		X	
aesthetics	X						X		X	

X = impact - O = no impact

(1) = Scope Definitions
S = site, 1.5 n mi radius.
L = local, up to 1 n mi outside of site.
R = region, beyond local vicinity of dumpsite.

(2) = Term
S = short, less than or equal to 5 hours.
E = extended, greater than 5 hours.

IV.E. MANAGEMENT OF THE DISPOSAL SITE

IV.E.1. INTRODUCTION

Management of an ocean dumping site remote from the usual mainland surveillance capabilities and research capacities presents some problems to EPA and to the fish canning industry in attempting to comply with monitoring requirements. The distance from headquarters does not preclude observation of dumping activities. Comments of the American Samoa Government and the public were considered in making the decision to ocean dump, and in being able to observe the dump vessel in action. There had not been the capability of technical monitoring of the waste in the field, except for several periods under NOAA and NMFS sponsorship (Soule and Oguri, 1983, 1984), until the issuance of research permits in 1986.

IV.E.1.a. GOALS

Goals of the management program are directed toward maintaining and enhancing the marine environment and protecting the public, the following objectives have been developed to implement the above goals:

1) To monitor the sources and quantities of contaminants in the waste streams.
2) To determine the direction and extent of the waste plume.
3) To evaluate the fate and effects of the waste plume.
4) To verify the predictions of the numerical model on trajectories and dilutions.
5) Determine compliance with EPA's ocean dumping criteria.

IV.E.1.b. Monitoring Difficulties

During the period of surveillance under Research Permits OD 86-01, 87-01, 88-01 and 88-02 monitoring of ocean dumping off American Samoa has been difficult at best, since the waters are rough and the weather variable. Navigation and communication systems are rudimentary and there is no Coast Guard facility. The availability of vessels large enough to perform monitoring in rough weather is poor, and those vessels available lack power supply for use of electronic gear or deck hoists for sampling, as well as deck shelter for equipment. The availability of personnel with experience in managing electronic instrumentation has been an ongoing problem.

The equipment considered to be basis for standard monitoring programs was not available in American Samoa and had to be brought in from the mainland. The InterOcean current meter, built to interface on shipboard with a computer, had to be downrigged to produce a deck readout since there is no sea going computer equipment available in American Samoa. There are no service facilities for this instrument except in San Diego. Electronic sensors in the Martek instruments which measure temperature, salinity, dissolved oxygen, pH and light transmittance are fragile and require continuing care in the field and laboratory, as well as hand carrying to Los Angeles for repairs, since there is no service available in American Samoa or in Hawaii.

IV.E.1.c. Public Observation of Dumping Activity

The public has opportunities for observing the ocean dumping activity since the dump vessel is readily visible from shore as it transports the wastes and can be seen at the dumpsite in good weather. Also, the dumpsite is clearly visible from the control tower of Pago Pago International Airport, and small planes overfly the site en route to the Manua Islands to the east or to Western Samoa to the west. If it is believed that a violation is occurring, or has occurred, the ASGEQC or the Coast Guard liaison officer in Pago Pago should be informed in writing of the time and location of observation with wind and tide data if available. A sample of material should be frozen for laboratory analysis, if possible.

IV.E.2. THE RESEARCH PERMIT PROGRAM

IV.E.2.a. Research Permit Requirements

Management procedures in existence under research permits OD 86-01, 87-01, 88-01 and 88-02 have been required by EPA Region 9 and the ASG Environmental Quality Commission. Copies of the EPA Fact sheets for the above permits are included in Chapter V. The current permit, OD 88-02, is included in Appendix C.

The permittees have been required to report each month on the following.

1) Daily volumes, in gallons per day, of each waste removed from each permittee's facility.

2) Monthly waste material analyses demonstrating that materials comply with permit limitations for:

Bulk density	Aluminum
pH	Chromium
Total suspended solids	Nickel
Total volatile solids	Copper
BOD_5	Lead
Total phosphorus	Cadmium
Total nitrogen	Mercury
Ammonia	Total Petroleum hydrocarbons
Oil and grease	Pesticides*
	PCBs*

* Analysis of total pesticides and PCBs was dropped after one year; measurements were below the limits of detection.

3) Monthly reports on the amount of coagulant polymer and alum added to the waste.

4) Monthly log book reports of daily dumping, including time of loading, position every 15 minutes, observations on wind speed and direction, wave height, flotable materials observed, and other conditions.

5) A monthly field sampling program which measures or makes

observations on the following parameters and organisms:

Currents	Total suspended solids
Weather	Total volatile solids
Wind direction and speed	Total phosphorus
Water color	Total nitrogen
Wave height and interval	Ammonia
Salinity	Fish
Dissolved Oxygen	Sea turtles
pH	Sea birds
Light transmission (%)	Whales
Secchi disk depth	

6) A comprehensive report at the end of each permit period was submitted to Region 9, with copies to the Environmental Quality Commission and the Coast Guard Liaison Office in American Samoa, and the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Honolulu.

V.E.2.b. Feasible Procedures

Over the long term, field monitoring of the scope included in the Research Permits was not considered to be necessary, and the difficulties of using a small boat and electronic equipment were demonstrated. The following procedures are considered to be feasible for surveillance:

1) Ammonia-N can be used to map dispersal and degradation of the plume, as was demonstrated by Soule and Oguri (1984,1986). This requires only that water samples be taken in the field and placed in acidified bottles, chilled and returned to the cannery laboratory. Bottles can be refrigerated until the laboratory is ready to perform analyses using an Orion ammonia probe and a pH meter. This is a much more accurate test than the traditional (BOD_5) test which requires a larger sample, chilling on board and immediate processing when the sampling vessel returns, usually in the late afternoon. Soule and Oguri (1984, 1986) demonstrated the positive correlation of Ammonia-N and BOD_5, and recommended use of the former in

monitoring.

2) Temperature and salinity data have proven interesting to scientists, especially since the effects of El Niño-Southern Oscillation (ENSO) events were discernible in the data (See Sections III.B.1 and III.B.2). However, there is no thermocline or halocline at the depths studied, and no significant differences were found in the values between dumpsite stations or controls. The tropical thermocline is generally found between 100 and 200 m (See Section III.B.3.c and Figure III.11). Thus, there is little need from the regulatory viewpoint for continuing to record these data, given the difficulties in keeping the instrumentation functional. This requirement will be dropped altogether.

3) Dissolved oxygen has been of critical interest, especially since the saturation levels in tropical waters are close to the requirements of some species of fish. Waters off American Samoa have been supersaturated on some occasions, reflecting the turbulent mixing in the dumpsite area. Efforts to find an oxygen sag in the plume required following the dump vessel as closely as possible in order to record a transitory oxygen sag (Soule and Oguri, 1983a). Levels have not fallen below the ASG water quality standard, which is 5 ppm, unless the natural background level is less. Otherwise, oxygen levels do not appear to be depressed by the plume, but probe malfunctions have led to some anomalous readings. Continuing to measure this parameter with fragile electronic equipment is probably unnecessary. Dissolved oxygen measurements would not be required at the Deeper Water Preferred Site since it is

outside ASG territorial waters.

IV.E.3. PROPOSED MONITORING PROGRAM

IV.E.3.a. Permit Requirements

Sufficient information on the fate and effects of fish cannery wastes in the marine environment has been accumulated in American Samoa to indicate that there is no significant impact on the marine environment and no threat to public health or welfare.

Monitoring under the 1980 special permit, coupled with research under grants from NOAA and NMFS, and monitoring under the 1986, 1987 and 1988 research permits has been extensive. EPA believes that such effort is no longer needed.

The following procedures shall be continued:

1) Monthly report on daily volumes (gallons) of each waste removed from both facilities.

2) Monthly analyses of each of the waste streams at their sources of the following;

Bulk density	BOD_5
pH	Total phosphorus
Total volatile solids	Total nitrogen
Ammonia-N	Oil and grease
Aluminum	

3) Monthly reports on the amount of coagulant polymer and alum added to the waste;

4) Monthly log books of daily dumping, including time of leaving, position every 15 minutes, observations on wind speed, wind direction, current direction determined at the center of the dumpsite, location of the dumping operation 0.3 n mi from the site boundary in the upcurrent portion of the site, and wave height, floatable materials and other conditions;

5) The field sampling program shall be conducted monthly or until

changed by EPA and shall consist of the following:

a) The dump vessel shall record the direction of surface current on arrival at the center of the site before dumping, and position the start of dumping 0.2 n mi inside the upcurrent perimeter.

b) The dump vessel shall take a water grab sample at the center of the disposal site, before dumping, for analyses of the same parameters, except BOD_5, listed in Ssection 2), above. The sample shall be preserved as needed in the field.

c) The dump vessel shall complete the dump and record the direction of the plume.

d) The dump vessel shall move to the leading edge of the plume 30 min. after dumping has ceased and take another grab sample.

e) Observations for whales, fish, turtles and birds shall be made.

At the end of each year of monthly monitoring EPA will evaluate the data to determine whether field monitoring may be reduced. All interested parties will be consulted before any changes in the monitoring program are made by EPA.

IV.E.3.b. Feasibility

It is less feasible to take water samples with a small boat at the deeper water site, since the wind and waves will probably be stronger and the transit time greater. Navigation would also be more difficult. The site is outside American Samoa territorial waters, so that determining compliance with ASG water quality parameters is not required. Field sampling in the patterns and frequency performed from the small boats is not feasible nor necessary, given the existing data base.

Extensive sampling from the dump vessel may be difficult because of the height to the deck for bringing up water samplers and the danger of damaging electronic sensors by crashing against the side of the vessel in rough seas. However, limited grab samples could be taken before dumping and at the leading edge of the plume after dumping, using a boom or davit to lower and raise water sampling equipment. The vessel could not transit the plume without breaking it up, making further measurements invalid.

IV.F. CUMULATIVE IMPACTS AS A RESULT OF THE PROJECT

No cumulative effects of ocean disposal are expected under presently permitted quantities of dumping. The currents and winds effectively dissipate the wastes, and none are measurable after four hours, nor are they visible on the morning following the previous day's disposal to indicate a buildup of wastes. The assimilative capacity of the open ocean is enormous. There should be no buildup of any pollutants under existing disposal practices.

There are no other waste disposal projects contemplated in the area. Dredged materials from the harbors have previously been used as fill. Maintenance dredge disposal would normally involve relatively small quantities, and would rarely occur. The only effluent pipe of significant size along the coast is the Tafuna domestic sewage outfall, which is southwest of the airport, and poses no threat of cumulative effects within the cannery waste dumping area.

Construction of a harbor at Leone, just northwest of Fagatele Bay, has been proposed, but the project, including disposal of dredged material has not been decided on at this time. Objections to that project include proximity to the National Marine Sanctuary at Fagatele Bay and to breeding and/or nursery grounds for the endangered humpback whale.

IV.G. RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM PRODUCTIVITY

Tropical ocean waters are generally depauperate and have a very low biological productivity. The increase in nutrients might stimulate a slight increase in primary productivity and in zooplankton and forage fish over a long period. However, concentrating mechanisms that would cause nutrients to remain in the area are apparently weak and so the prospect of enhancement is limited. Even though the sites are close to each other, the present site and plume are influenced by the longshore current and by the island mass more than the deeper water site would be. Local fishermen favor ocean disposal because they believe that the increase in nutrients is beneficial to the food web.

IV.H. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

There are no irreversible and irretrievable commitments of resources involved in this ocean dumping project.

CHAPTER V. COORDINATION

V.A. SCOPING AND PUBLIC COMMENTS

V.A.1. FEDERAL REGISTER NOTICES

Notice of the intent to prepare an environmental impact statement (EIS) on the final designation of an ocean disposal site off Pago Pago, American Samoa was published in the Federal Register on February 13 1987 (52 FR 4657 (see p. V-3). The 1980 site designation was published in Federal Register on November 24, 1980 (45 FR 77434 (see p. V-4, V-5). The notice of availability of the Draft Environmental Impact statement was published in The Federal Register on September 16, 1988 (53 FR 36118) (see p. V-6).

V.A.2. EPA FACT SHEETS

Following the Federal Register notices are the fact sheets issued by EPA Region 9 for Permits OD 86-01, 87-01, 88-01 and 88-02 (p. V-7 to V-34). It will be noted that the quantity of wastes was reduced in the second permit, because Samoa Packing deleted thaw water from their sector. No thaw water was being dumped, and hence the total gallonage per day in the permit was reduced from 576,900 gal/day to 256,900 gal/day. Daily dumping has normally been less than 50,000 gals/day, but could reach 100,000 gals/day in the near future if the canners dispose of precooker and press waters along with the DAF sludge. Samoa Packing is presently dumping press water with the sludge but Star-Kist is not. Neither is dumping precooker water. The increased quantity will tend to dilute the sludge waste, since it represents a diversion of liquid waste streams in the plant from the DAF treatment system directly to the ocean dumping vessel. The remaining amount permitted is for emergency purposes, in case the waste could not be dumped due to sea conditions, or breakdown in plant operations or the vessel, and the canners could dispose of the stored volumes.

V.A.3. COMMENTS AND RESPONSES TO NOTICE OF INTENT

Comments received regarding the notice of intent and the EPA responses are appended. No objections to the permit were received. Star-Kist Samoa took the lead for the two canners in negotiating the terms of the permits, and most of the comments received were from Star-Kist, related to details of the permit requirements.

[ER-FRL-3155-9]

Designation of an Ocean Disposal Site for Fish Cannery Wastes Off Pago Pago, American Samoa; Intent To Prepare an Environmental Impact Statement

AGENCY: U.S. Environmental Protection Agency (EPA), Region 9.

ACTION: Notice of Intent to prepare an environmental impact statement (EIS) on the final designation of an ocean disposal site for cannery wastes off Pago Pago, American Samoa.

PURPOSE: The U.S. EPA, Region 9, in accordance with Section 102(2)(c) of the National Environmental Policy Act (NEPA) and in cooperation with Star-Kist Foods, Inc. and Ralston Purina Company, will prepare a Draft EIS on the designation of an ocean disposal site for cannery wastes of Pago Pago, American Samoa. The cannery wastes are produced at fish processing facilities owned and operated by Star-Kist Samoa, Inc. and Samoa Packing Company. An EIS is needed to provide the information necessary to designate an ocean disposal site for these wastes. This Notice of Intent is issued pursuant to section 102 of the Marine Protection, Research and Sanctuaries Act of 1972, and 40 CFR Part 228 (Criteria for the Management of Disposal Sites for Ocean Dumping).

For Further Information and To Be Placed on the Mailing List

Contact: Patrick Cotter, Oceans and Estuaries Section (W-5-3), U.S. Environmental Protection Agency, Region 9, 215 Fremont Street, San Francisco, California 94105, telephone number (415) 974-0257 or FTS 454-0257.

Summary: Site designation is needed to provide a suitable disposal site for cannery wastes which can only be disposed of after EPA Region 9 has determined that the wastes meet EPA's ocean disposal criteria (40 CFR Part 227), including a demonstration of need for ocean disposal. EPA Region 9 will issue a research permit under section 102 of MPRSA, to gather information related to the EIS.

The cannery wastes consist of dissolved air flotation (DAF) sludge, precooker water, press water, thaw water and grit. DAF sludge is produced when floatable solids and waste water from treatment processes are mixed with alum and coagulant polymers.

The center of the proposed disposal site is located 2.35 nautical miles off the island at coordinates 14°22′11″ South latitude by 170°40′52″ West longitude. The diameter of the site is 1.5 nautical miles and the average water depth is 1450 meters. The site would be designated for continued use.

Need for Action

Star-Kist Foods, Inc. and Ralston Purina Company applied for an ocean dumping permit off American Samoa on behalf of their subsidiary companies. An EIS is required to provide the necessary information to evaluate alternatives and designate the preferred site.

Alternatives

The EIS will characterize the oceanographic parameters of the disposal site and evaluate a reasonable range of alternatives. The alternatives include: (1) Proposed Site (Preferred Alternative), (2) Shallow Water Site, (3) Site Farther From Shore, (4) Land Disposal Options and (5) No Action.

Scoping

A scoping meeting is not contemplated. Scoping will be accomplished by correspondence with affected Federal, State and local agencies, interested parties, and by correspondence.

Estimated Date of Release

The draft EIS will be made available in June 1987.

Responsible Official

Judith F. Ayres, Regional Administrator, Region 9.

Richard E. Sanderson,

Director, Office of Federal Activities.

[FR Doc. 87-3148 Filed 2-12-87; 8:45 am]

BILLING CODE 6560-50-M

77434 Federal Register / Vol. 45, No. 228 / Monday, November 24, 1980 / Rules and Regulations

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 228

[WH-FRL 1679-7]

Ocean Dumping; Final Designation of Site

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: EPA today designates a fish cannery waste site in the Pacific Ocean as an EPA approved interim ocean dumping site. this action is necessary to provide a site for the dumping of fish cannery wastes originating in American Samoa which can no longer be accommodated on land. This action will permit the dumping of these wastes on an interim basis until an Environmental Impact Statement can be prepared on this site.

DATE: This site designation shall become effective on November 24, 1980.

FOR FURTHER INFORMATION CONTACT: Mr. T. A. Wastler, Chief, Marine Protection Branch (WH-548), EPA, Washington, DC 20460. 202/472-2836.

SUPPLEMENTARY INFORMATION: Section 102(c) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq., (hereafter "the Act") gives the Administrator of EPA the authority to designate sites where ocean dumping may be permitted. On September 19, 1980, the Administrator delegated the authority to designate ocean dumping sites to the Assistant Administrator for Water and Waste Management. This final interim site designation is being made pursuant to that authority.

The EPA Ocean Dumping Regulations (40 CFR Chapter I, Subchapter H, § 228.4) state that ocean dumping sites will be designated by publication in this Part 228. EPA designated "Approved Interim and Final Ocean Dumping Sites" on January 11, 1977 (42 FR 2461 et seq.) and extended the designations on January 16, 1980 (45 FR 3053 et seq.).

On August 25, 1980, EPA proposed designation of an additional approved interim ocean dumping site. (45 FR 56374.) The proposed new site is in the Pacific Ocean and would be used solely for the dumping of fish cannery wastes originating in American Samoa. The public comment period expired on October 24, 1980.

The proposed rulemaking contained detailed information regarding the need for an ocean dumping site for the disposal of these fish cannery wastes, the properties of the wastes, and an evaluation of the factors to be considered in site selection in relation to this particular site.

Three comments were received in response to the notice of proposed rulemaking. The comments and responses follow.

Comment: One commenter felt that the restriction of use of the dumpsite for fish cannery waste was too general and would allow the disposal of a wide variety of materials at the proposed site. He suggested that the proposed rule be amended to limit the dumping exclusively to the pollutants discussed and that the rule specifically mention that future use of the site after the rule has expired be contingent upon the filing of an acceptable Environmental Impact Statement (EIS) and public notice in the Federal Register.

Response. Designation of a dumping site is only part of the total action required for approval of an ocean dumping operation. Site designations are made in terms of the generic type of wastes for which the site is to be used (e.g., industrial wastes, sewage sludge, dredged material, containerized wastes). The ocean dumping permit itself, which is the actual authorization for dumping in any particular case, specifies not only the processes from which the waste is generated but also the detailed physical and chemical characteristics of the wastes which may be dumped. Proposed actions on permit applications are also subject to public comment and opportunity for public hearing, and it is in the action on permit applications that specific requirements are placed on the applicant as to the volume and type of waste that may be dumped.

As noted by the comment, the interim site designation exists only for a specific period of time, and dumping at this site will be allowed only during the stated time. The site may not be used after this interim period unless an EIS is prepared and the site is designated as a finally approved site through further formal rulemaking.

Comment: The National Marine Fisheries Service commented that recent research has shown that it is feasible to use this type of organic waste for methane gas production and suggested that the government of American Samoa might care to explore this approach in this particular case. If practical in this situation, this process could result in generation of energy combined with a decrease in the volume of waste disposed of at sea.

Response: EPA agrees fully that wherever possible wastes should be used for beneficial purposes, and the ocean dumping regulations require that land-based methods of disposal, including recycling and reuse, be considered in determining whether or not an ocean dumping permit should be issued. This suggestion by the National Marine Fisheries Service has been referred to the permit applicants and the government of American Samoa, and EPA Region IX will work with them to determine the feasibility of this technique for the situation in American Samoa.

Comment: EPA Region IX pointed out the difficulties involved in conducting the necessary environmental studies at a location so far removed from adeouate scientific support facilities. The logistical requirements in regard to deploying a suitable vessel at American Samoa and having laboratory analyses done in Hawaii or California will significantly lengthen the time necessary to complete the field surveys necessary before an EIS can be begun. Region IX requested that the interim designation be extended to 36 months rather than 24 months so as to allow time to complete the field work and EIS in a thorough manner.

Response: In view of the difficulties pointed out by EPA Region IX, the interim designation is made for 36 months. This is regarded as an adequate length of time for completion of the necessary studies and preparation of an EIS, and no extension of the interim designation beyond this time is contemplated.

Management authority for this site will be delegated to the Regional Administrator of EPA Region IX.

Although this site designation may have substantial local impacts in the vicinity of the dump site and to those who use it, we have determined that this proposed rule is not a "significant" regulatory action within the meaning of Executive Order 12044, Improving Government Regulations (March 23, 1978).

(33 U.S.C. 1412 and 1418)

Dated: November 18, 1980.

Eckardt C. Beck,

Assistant Administrator for Water and Waste Management.

In consideration of the foregoing, Subchapter H of Chapter I of Title 40 is amended by adding to § 228.12(a) an ocean dumping site for Region IX as follows:

§ 228.12 Delegation of management authority for interim ocean dumping sites.

(a) * * *

Approved interim dumping sites.

* * * * *

Fish Cannery Wastes Site—Region IX.
Location: Latitude—14d22'S;
Longitude—170d41'W (center point).
Size: 1 nautical mile in diameter.
Depth: 1,200 meters (4,000 feet).
Primary Use: Fish cannery wastes.
Period of Use: Site will expire (36 months after date of publication).
Restriction: Disposal shall be limtied to not more than 130,000 tons per year of fish cannery wastes generated on the island of Tutuila, American Samoa.

[FR Doc. 80-36567 Filed 11-21-80; 8:45 am]
BILLING CODE 6560-29-M

[ER-FRL-3448-8]

Environmental Impact Statements; Availability

Responsible Agency: Office of Federal Activities, General Information (202) 382-5076 or (202) 382-5075.

Availability of Environmental Impact Statements Filed September 5, 1988 Through September 9, 1988 Pursuant to 40 CFR 1506.9.

EIS No. 880295, Draft, BLM, NM, White Sands Resource Management Plan, McGregor Range, Implementation, Otero County, NM, Due: January 3, 1989, Contact: Robert Alexander (505) 525-8228.

EIS No. 880296, FSuppl, SFW, AK, Kenai National Wildlife Refuge Comprehensive Conservation Management Plan, Wilderness Recommendations, Designation or Nondesignation, Kenai Peninsula Borough, AK, Due: October 17, 1988, Contact: William Knauer (907) 786-3399.

EIS No. 880297, Draft, COE, IL, Liverpool Village Flood Control Project, Implementation, Illinois River, Fulton County, IL, Due: October 31, 1988, Contact: Ron Klump (307) 788-6361.

EIS No. 880298, Final, FHW, NJ, US 206 (Section 5) Improvement, CR-518 to Routes US 202, NJ-28 and US 206 Intersection/ Somerville Circle, Implementation, Funding and 404 Permit, Somerset County, NJ. Due: October 17, 1988, Contact: Andreas Fekete (609) 530-2824.

EIS No. 880299, Final, NOA, ATL, MXG, Atlantic, Gulf and Caribbean Exclusive Economic Zones (EEZ) Billfish Fishery Management Plan, White and Blue Marlin, Sailfish and the Longbill Spearfish, Implementation, Due: October 17, 1988, Contact: Dr. Joseph Angelovic (813) 893-3141.

EIS No. 880300, Draft, EPA, AS, Tutuila Island Offshore Ocean Disposal Site Designation for Fish Cannery Waste,

AS, Due: October 31, 1988, Contact: Patrick Cotter (415) 474-0257.

V.A.2.

FACT SHEET

OCEAN DUMPING PERMIT OD 86-01 RESEARCH

STAR-KIST SAMOA, INC. AND SAMOA PACKING COMPANY, INC.
PAGO PAGO, AMERICAN SAMOA

I. Summary

The U.S. Environmental Protection Agency (EPA) Region 9 has received complete applications from Star-Kist Foods, Inc. and Ralston Purina Co., Inc. (Van Camp Seafood Division) for ocean disposal of fish processing wastes off Tutuila Island, American Samoa. The applications were made on behalf of their subsidiaries, Star-Kist Samoa, Inc. and Samoa Packing Company, Inc., respectively. In accordance with EPA's authority established in Sections 101 and 102 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) 33 U.S.C. §1401 et seq., the Regional Administrator has tentatively decided to issue a joint research permit to the subsidiary companies for ocean disposal of fish processing wastes over a six month period.

The monitoring program included in the research permit is designed to identify potential sources of pollution from the plant waste streams, to ensure that American Samoa Water Quality Standards are not violated and to determine whether ocean dumping is likely to unreasonably degrade or endanger human health or the marine environment. EPA Region 9 will not proceed with final approval of this research permit without public comment, or the concurrence of the American Samoa Government and other Federal agencies required under EPA's Ocean Dumping Regulations at 40 CFR 220 through 229.

The draft research permit and the administrative record are available for public review at EPA's Regional Office at 215 Fremont Street, San Francisco and the Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa. The administrative record sets forth the principal facts and the significant legal, methodological and policy questions considered in the development of the research permit.

II. Description of the Proposed Project

A. Project Overview

The two fish canneries in American Samoa, Star-Kist Samoa and Samoa Packing Company, propose to ocean dispose of fish processing wastes at a dump site centered approximately 2.1 nautical miles south of Tutuila Island in 900 fathoms (5,400 feet or 1,800 meters) of water. The waste materials will be transported to the site and discharged at a rate less than or equal to 700 gallons per minute while the vessel maintains a speed of 5.0 knots within a 0.2 nautical mile diameter circle.

The receiving waters, at the above location, are classified as "oceanic" by the American Samoa Water Quality Standards. These waters are characterized by low values for turbidity, nitrogen, phosphorus and chlorophyll a; a high degree of light penetration; near saturation values for dissolved oxygen; and a wide range of pH values. Four hours after dumping has ceased, concentrations of the above parameters must return to the ambient levels defined in the American Samoa Water Quality Standards.

B. Location of Disposal Site

If the permit is issued, transportation for the purpose of ocean dumping would terminate at, and waste disposal would be confined to a circular area with a 1.5 nautical mile diameter centered at 14° 22' 11" South latitude by 170° 40' 52" West longitude.

III. EPA's Authority To Issue Ocean Dumping Permits

A. EPA's authority to issue ocean dumping permits is defined under Sections 101 and 102 of MPRSA and at 40 CFR 220.4. The authority to issue research permits was delegated to the regional offices on July 25, 1984.

B. Section 101(b) authorizes the Administrator to issue permits necessary to conduct research. Section 101(b)(3) directs that EPA shall consult with the Secretary of Commerce to ensure that the potential benefits of a research permit outweigh any potentially adverse impacts during the study period. This subsection also limits the term of a research permit to six months.

C. Section 102 of MPRSA gives EPA the authority to issue permits for disposal of wastes other than dredge material. A formal site designation does not have to occur in order to issue a research permit. Future long-term use of this site will depend upon evaluation of data generated during the research permit and the applicants' demonstration of need regarding ocean disposal.

IV. Tentative Decision and Summary of Factors Considered in Reaching the Permit Decision

Star-Kist Samoa and Samoa Packing Company have applied for an Ocean Dumping Permit to dispose of their fish cannery wastes near Pago Pago, American Samoa. EPA Region 9 is planning to grant their application by issuing them a Research Ocean Dumping Permit for a period of six months.

Information developed during the permit period will be used to determine whether dumping on a more permanent basis would unreasonably degrade or endanger human health, the marine environment, ecological systems or economic potentialities [33 U.S.C. §1412a(1)(B)]. The permittees will be required to conduct an EPA Region 9-approved site monitoring program, including laboratory analyses and bioassays, to document that environmental impacts in the ocean will not be unreasonable and that American Samoa Water Quality Standards will be met. This information will be used to augment EPA's efforts to formally designate an ocean disposal site, according to EPA's Environmental Impact Statement policy for ocean dump sites, and to issue a Special Ocean Dumping Permit under 40 CFR 227 if appropriate.

The scale of the proposed dumping during the research period is expected to have minimal adverse impact on human health and/or the environment. While more data are needed to confirm the absence of unreasonable adverse effects from the discharge of fish wastes adulterated with alum and a coagulant polymer, the existing data indicate that impacts at the site should be minimal. The primary environmental impact of the proposed discharges would be short-term increases in turbidity, inorganic nutrients, biological oxygen demand and ammonia during the dumping event. Preliminary scientific studies of ocean disposal of DAF sludge in American Samoa indicate that water quality parameters should return to ambient conditions following the period of initial mixing after an ocean dumping event. To ensure that American Samoa Water Quality Standards are not exceeded after the period of initial mixing, restrictive disposal rates and limitations on the waste material constituents will be established in the permit. Hence, EPA believes that the benefit of assessing the impact of the discharging fish cannery wastes outweighs any adverse impact that may occur as a result of permitting the discharge for six months.

V. Terms of the Proposed Permit

A. Description of Waste Material

During the term of the research permit, and in accordance with all other terms and conditions of the permit, the permittees would be authorized to transport for disposal into ocean waters quantities of waste material that shall not exceed the following amounts:

Waste Material	Star-Kist Samoa (gallons/day)	Samoa Packing Co. (gallons/day)	Total Permitted Discharge (gallons/day)
DAF Sludge	60,000	31,400	91,400
Precooker Water	100,000	13,300	113,300
Press Water	40,000	12,200	52,200
Thaw Water	0	320,000	320,000
Total Maximum Daily Volume	200,000	376,900	576,900

B. Waste Material Limitations in the Proposed Permit

1. The Permitted Maximum Concentrations were determined based on waste material concentrations provided by the applicants in their amended permit applications.

Fish Processing Waste Material	Total Permitted Daily Volume To Be Dumped	Permitted Maximum Concentration Per Constituent	
DAF Sludge[a]	91,400 gal/day	Tot. Sus. Solids	219,000 mg/L
		BOD_5	269,000 mg/L
		Total Phosphorus	26,629 mg/L
		Total Nitrogen	44,854 mg/L
		Oil and Grease	345,000 mg/L
Precooker Water[a]	113,300 gal/day	Tot. Sus. Solids	65,000 mg/L
		BOD_5	82,100 mg/L
		Total Phosphorus	1,162 mg/L
		Total Nitrogen	9,930 mg/L
Press Water[a]	42,200 gal/day	Tot. Sus. Solids	239,000 mg/L
		BOD_5	144,200 mg/L
		Total Phosphorus	2,200 mg/L
		Total Nitrogen	18,210 mg/L
Thaw Water[b]	320,000 gal/day	BOD_5	1,180 mg/L
		Total Phosphorus	43 mg/L
		Total Nitrogen	361 mg/L

a = Maximum Permitted Concentrations are assumed to be highest if the vessel contains waste material only from the Star-Kist Samoa plant. Concentrations listed for each of the waste materials were provided by Star-Kist, Samoa.

b = Samoa Packing Company only.

2. The pH range for all waste material will be between 5.5 and 7.0 pH units.

3. The Permitted Maximum Concentrations and pH range, listed above, shall not be exceeded at any time during the term of this permit.

VI. Administrative Procedures

A. The processing of an Ocean Dumping Permit consists of the following actions:

1. EPA receives a completed application (40 CFR 221).

2. EPA issues a tentative decision whether to grant or deny the research permit (40 CFR 222.2). A draft permit is the means by which EPA documents the intent to grant a ocean dumping permit.

3. A public notice is issued to announce EPA's intent to issue a permit (40 CFR 222.3). The notice contains the following elements: summary, tentative determination, hearing process, factors considered in reaching the tentative determination and the location of all information on the draft permit. Public notices describing EPA's intent to issue a permit are published in a daily newspaper in closest proximity to the proposed dump site and in a daily newspaper in the city in which EPA's regional office is located.

4. Before a final decision can be made on the research permit, formal consultation must be documented with the following agencies American Samoa Government, U.S. Army Corps of Engineers, U.S. Coast Guard, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Shellfish Sanitation Branch of the Food and Drug Administration.

B. Initiation of a Public Hearing

1. Within 30 days of the date of the public notice, any person may request a public hearing to consider issuance or denial of the research permit or conditions to be imposed upon

this permit. Any request for a hearing must be made in writing, must identify the person requesting the hearing, and must clearly state any objections to issuance or denial of the permit or to the conditions to be imposed upon the permit, and the issues to be considered at the hearing. In accordance with 40 CFR 222.4, the Regional Administrator may schedule a hearing, at her discretion, based on genuine issues presented in the written request or the necessity to hold a public hearing.

2. Upon receipt of a written request presenting genuine issues amenable to resolution by a public hearing, the Regional Administrator determines a time and place for the hearing and publishes a notice of the hearing. All interested parties are invited to be present or represented at the hearing to express their views on the proposed issuance or denial of the permit. If a request for a public hearing is made within 30 days of the date of this notice and does not meet the above criteria, the Regional Administrator must advise the requesting person in writing and proceed to rule on the application.

3. Following adjournment of the public hearing, the Presiding Officer, appointed by the Regional Administrator, prepares written recommendations relating to the issuance, denial or conditions to be imposed upon the permit after full consideration of the views and arguments expressed at the hearing (40 CFR 222.6 to 222.8). The Presiding Officer's recommendations and the record of the hearing are forwarded to the Regional Administrator within 30 days of the hearing.

4. The Regional Administrator makes a determination whether to issue, deny or impose conditions on the permit within 30 days of receipt of the Presiding Officer's recommendations. She must give written notice of the decision to any person registered at the public hearing (40 CFR 222.9).

5. A final permit becomes effective 10 days after issuance, if no requests for an adjudicatory hearing are received. Requests for an adjudicatory hearing may be made within 10 days of receipt of the notice to issue or deny the permit (40 CFR 222.10 to 222.11). An appeal of the adjudicatory hearing decision may be made in writing to the Administrator within 10 days following receipt of the Regional Administrator's determination on the adjudicatory hearing (40 CFR 222.12).

VI. <u>Additional Information</u>

The application, related documents, comments received, fact sheet and the draft research permit are on file at the U.S. Environmental Protection Agency, Region 9, Oceans and Estuaries Section (W-5-3), 215 Fremont Street, San Francisco, California 94105 or the American Samoa Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa 96799. These documents may be inspected, and arrangements made for copying at a charge of $0.20 per copy sheet, at the above offices between 8:00 a.m. and 4:00 p.m., Monday through Friday. For further information on the research permit or questions pertaining to MPRSA regulations, please contact:

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Oceans & Estuaries Section
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FACT SHEET

OCEAN DUMPING PERMIT OD 87-01 RESEARCH

STAR-KIST SAMOA, INC. AND SAMOA PACKING COMPANY, INC.
PAGO PAGO, AMERICAN SAMOA

I. Summary

The U.S. Environmental Protection Agency (EPA) Region 9 has received complete applications from Star-Kist Foods, Incorporated and Ralston Purina Company, Incorporated for ocean disposal of fish processing wastes off Pago Pago, American Samoa. The applications were made on behalf of their subsidiaries, Star-Kist Samoa, Incorporated and Samoa Packing Company, Incorporated, respectively. In accordance with EPA's authority established in Sections 101 and 102 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) (33 U.S.C. 1401 et seq.), the Regional Administrator has tentatively decided to issue a joint research permit to the subsidiary companies for ocean disposal of fish processing wastes over a six month period.

The monitoring program included in the research permit has been revised from the one required in EPA Region 9's ocean dumping permit OD 86-01. The program is designed to identify potential sources of pollution from the plant waste streams, to ensure that American Samoa Water Quality Standards are not violated, and to determine whether ocean dumping is likely to unreasonably degrade or endanger human health or the marine environment. EPA Region 9 will not proceed with final approval of this research permit without public comment, or the concurrence of the American Samoa Government and other Federal agencies required under EPA's Ocean Dumping Regulations at 40 CFR 220 through 229.

The draft research permit and the administrative record are available for public review at EPA's Regional Office, 215 Fremont Street, San Francisco, California and the Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa. The administrative record sets forth the principal facts and the significant legal, methodological and policy questions considered in the development of the research permit.

II. Description of the Proposed Project

A. Project Overview

The two fish canneries in American Samoa, Star-Kist Samoa and Samoa Packing Company, propose to ocean dispose of fish processing wastes at a dump site centered approximately 2.1 nautical miles south of Tutuila Island in 900 fathoms (5,400 feet or 1,800 meters) of water. The waste materials will be transported to the site and discharged at a rate less than or equal to 1400 gallons per minute at a maximum speed of 10 knots within a 0.2 nautical mile radius circle.

The receiving waters, at the above location, are classified as "oceanic" by the American Samoa Water Quality Standards. These waters are characterized by low values for turbidity, nitrogen, phosphorus and chlorophyll _a_; a high degree of light penetration; near saturation values for dissolved oxygen; and a wide range of pH values. Four hours after dumping has ceased, concentrations of the above parameters must return to the ambient levels (40 CRF 227.29) defined in the American Samoa Water Quality Standards. EPA Region 9 will evaluate potential impacts to water quality based on the data obtained from the reference site stipulated in the permit, and the American Samoa Water Quality Standards.

B. Location of Disposal Site

If the permit is issued, transportation for the purpose of ocean dumping would terminate at, and waste disposal would be confined to a circular area with a 1.5 nautical mile diameter centered at 14° 22' 11" South latitude by 170° 40' 52" West longitude.

III. EPA's Authority To Issue Ocean Dumping Permits

A. EPA's authority to issue ocean dumping permits is defined under Sections 101 and 102 of MPRSA and at 40 CFR 220.4. The authority to issue research permits was delegated to the regional offices on July 25, 1984.

B. Section 101(b) of MPRSA authorizes the Administrator to issue permits necessary to conduct research. Section 101(b)(3) directs that EPA shall consult with the Secretary of Commerce to ensure that the potential benefits of a research permit outweigh any potentially adverse impacts during the study period. This subsection also limits the period of a research permit to six months.

C. Section 102 of MPRSA gives EPA the authority to issue permits for disposal of wastes other than dredge material. A formal site designation does not have to occur in order to issue a research permit. Future long-term use of this site will depend upon evaluation of data generated during the previous research permit (OD 86-01), results of monitoring contained in this proposed permit, and the applicants' demonstration of need regarding ocean disposal.

IV. Tentative Decision and Summary of Factors Considered in Reaching the Permit Decision

Star-Kist Samoa and Samoa Packing Company have applied for an Ocean Dumping Permit to dispose of their fish cannery wastes near Pago Pago, American Samoa. EPA Region 9 is planning to grant their application by issuing them a research ocean dumping permit for a period of six months.

Information developed during the permit period plus data from the previous permit (OD 86-01) will be used to determine whether dumping on a more permanent basis would unreasonably degrade or endanger human health, the marine environment, ecological systems or economic potentialities [33 U.S.C. 1412a(1)(B)]. The permittees will be required to conduct a revised EPA Region 9-approved site monitoring program, including laboratory analyses and possible bioassay tests, to document that environmental impacts in the ocean will not be unreasonable and that American Samoa Water Quality Standards will be met. This information will be used to augment EPA's efforts to formally designate an ocean disposal site according to the agency's voluntary environmental impact statement policy for ocean disposal site designation (39 FR 37119, October 24, 1974), and to issue a special ocean dumping permit under 40 CFR 227, if appropriate.

The scale of the proposed dumping during the research period is expected to have minimal adverse impact on human health and/or the environment. While more data are needed to confirm the absence of unreasonable adverse effects from the discharge of fish wastes adulterated with alum and a coagulant polymer, the existing data indicate that impacts at the site should be minimal. The primary environmental impact of the proposed discharges would be short-term increases in turbidity, inorganic nutrients, biological oxygen demand and ammonia during the dumping event. Preliminary scientific studies of ocean disposal of dissolved air flotation (DAF) sludge in American Samoa indicate that water quality parameters should return to ambient conditions following the period of initial mixing after an ocean dumping event (40 CFR 227.29). To ensure that American Samoa Water Quality Standards are not exceeded after the period of initial mixing, restrictive disposal rates and limitations on the waste material constituents are defined in the permit. Hence, EPA believes that the benefit of assessing the impact of the discharging fish cannery wastes outweighs any adverse impact that may occur as a result of permitting the discharge for six months.

V. Terms of the Proposed Permit

A. Description of Waste Material

During the term of the research permit, and in accordance with all other terms and conditions of the permit, the permittees would be authorized to transport for disposal into ocean waters quantities of waste material that shall not exceed the following amounts:

Waste Material	Star-Kist Samoa (gallons/day)	Samoa Packing Co. (gallons/day)	Total Permitted Discharge (gallons/day)
DAF Sludge	60,000	31,400	91,400
Precooker Water	100,000	12,200	112,200
Press Water	40,000	40,000	80,000
Total Maximum Daily Volume	200,000	83,600	283,600
Grit	100 tons/month	0	100 tons/month

B. Waste Material Limitations in the Proposed Permit

1. The Permitted Maximum Concentrations were determined based on waste material concentrations provided by the applicants in their amended permit applications.

Fish Processing Waste Material	Total Permitted Daily Volume To Be Dumped	Permitted Maximum Concentration Per Constituent	
DAF Sludge[a]	91,400 gal/day	Tot. Sus. Solids	219,000 mg/L
		BOD_5	269,000 mg/L
		Total Phosphorus	26,629 mg/L
		Total Nitrogen	44,854 mg/L
		Oil and Grease	345,000 mg/L
Precooker Water[a]	113,300 gal/day	Tot. Sus. Solids	65,000 mg/L
		BOD_5	82,100 mg/L
		Total Phosphorus	1,160 mg/L
		Total Nitrogen	9,930 mg/L
Press Water[a]	42,200 gal/day	Tot. Sus. Solids	285,000 mg/L
		BOD_5	144,200 mg/L
		Total Phosphorus	3,810 mg/L
		Total Nitrogen	18,210 mg/L
Grit[b]	100 tons/month	Solid Phase	
		Settled Solids	47.0% wet wt.
		Volatile Solids	28.3% wet wt.
		Moisture	53.9% wet wt.
		Liquid Phase	
		Tot. Sus. Solids	33.0 mg/L
		Total Nitrogen	271.0 mg/L
		Oil and Grease	18.0 mg/L

a = Maximum Permitted Concentrations are assumed to be highest if the vessel contains waste material only from the Star-Kist Samoa plant. Concentrations listed for each of the waste materials were provided by Star-Kist Samoa.

b = Star-Kist Samoa, Inc. only

2. The pH range for all waste material will be between 5.5 and 7.0 pH units.

3. The Permitted Maximum Concentrations and pH range, listed above, shall not be exceeded at any time during the term of this permit.

4. Detection limits have been specified for all analytical parameters (see Special Condition 3.1.2).

5. The American Samoa Government asked that they be given the responsibility to permit the disposal of grit (June 22, 1987). After discussions with representatives of Star-Kist Foods on July 14, 1987, EPA Region 9 determined that grit and waste streams flowing into the surge tank where grit settles may have waste water from plant washing operations, containing detergents and lubrication products. Since the plant is constructed in this configuration, grit derived from the surge tank would not be exempt under 40 CFR 220.1(c)(1) and is subject to permitting under Section 102 of MPRSA.

   EPA has not received an application to dispose of grit from the Samoa Packing Company. If the cannery desires to dispose of grit, then this material should be included in the formal application of ocean disposal.

C. Changes in the Monitoring Program

1. The locations of the sampling stations were changed to allow the permittees to monitor the disposal plume more closely over the entire period of dumping. This includes the four hour time period after dumping has ceased as specified by the definition of limiting permissible concentration at 40 CFR 227.29 (see Sections 1.1 and 1.3.1).

2. The maximum depth at which samples will be taken was changed from 20 to 10 meters because the disposal plume never reached the 20 meter depth (see Sections 1.2.3 and 1.3.5).

3. Detection limits have been specified for all parameters to be sampled (see Sections 1.2.2 and 1.3.5).

4. Requirements for plume/drogue tracking were combined into an overall sampling strategy that will allow better use of resources at the disposal site. More relevant data will be obtained using these new procedures (see Sections 1.4 and 1.5).

5. Additional bioassays may be need if circumstances beyond the control of the permittees prevent the full set of three bioassays from being completed as specified in the previous research permit (OD 86-01). An additional isopod bioassay test species, Eurydice caudata, has been added as a result of problems with control stocks at the laboratory employed by the permittees (see Section 2.2).

6. Permit reporting, in general, has been substantially strengthened and highlighted as a very important part of permit compliance (see General Condition 1.2.3; Special Conditions 3.3.2, 3.3.3, 4.6.1, 5.2, 5.3.2; and Section 2.2.5).

VI. Administrative Procedures

A. The processing of an ocean dumping permit consists of the following actions:

1. EPA receives a completed application (40 CFR 221).

2. EPA issues a tentative decision whether to grant or deny the research permit (40 CFR 222.2). A draft permit is the means by which EPA documents the intent to grant an ocean dumping permit.

3. A public notice is issued to announce EPA's intent to issue the permit (40 CFR 222.3). The notice contains the following elements: summary, tentative determination, hearing process, factors considered in reaching the tentative determination and the location of all information on the draft permit. Public notices describing EPA's intent to issue a permit are published in a daily newspaper in closest proximity to the proposed dump site and in a daily newspaper in the city in which EPA's regional office is located.

4. Before a final decision can be made on the research permit, formal consultation must be documented with the following agencies: American Samoa Government, U.S. Army Corps of Engineers, U.S. Coast Guard, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Shellfish Sanitation Branch of the Food and Drug Administration.

B. Initiation of a Public Hearing

1. Within 30 days of the date of the public notice, any person may request a public hearing to consider issuance or denial of the research permit or conditions to be imposed upon this permit. Any request for a hearing must be made in writing; must identify the person requesting the hearing; and must clearly state any objections to issuance or denial of the permit or to the conditions to be imposed upon the permit, and the issues to be considered at the hearing. In

accordance with 40 CFR 222.4, the Regional Administrator may schedule a hearing, at her discretion, based on genuine issues presented in the written request or the necessity to hold a public hearing.

2. Upon receipt of a written request presenting genuine issues amenable to resolution by a public hearing, the Regional Administrator determines a time and place for the hearing and publishes a notice of the hearing. All interested parties are invited to be present or represented at the hearing to express their views on the proposed issuance or denial of the permit. If a request for a public hearing is made within 30 days of the date of this notice and does not meet the above criteria, the Regional Administrator must advise the requesting person in writing and proceed to rule on the application.

3. Following adjournment of the public hearing, the Presiding Officer, appointed by the Regional Administrator, prepares written recommendations relating to the issuance, denial or conditions to be imposed upon the permit after full consideration of the views and arguments expressed at the hearing (40 CFR 222.6 to 222.8). The Presiding Officer's recommendations and the record of the hearing are forwarded to the Regional Administrator within 30 days of the hearing.

4. The Regional Administrator makes a determination whether to issue, deny or impose conditions on the permit within 30 days of receipt of the Presiding Officer's recommendations. She must give written notice of the decision to any person registered at the public hearing (40 CFR 222.9).

5. A final permit becomes effective 10 days after issuance, if no requests for an adjudicatory hearing are received. Requests for an adjudicatory hearing may be made within 10 days of receipt of the notice to issue or deny the permit (40 CFR 222.10 to 222.11). An appeal of the adjudicatory hearing decision may be made in writing to the Administrator within 10 days following receipt of the Regional Administrator's determination on the adjudicatory hearing (40 CFR 222.12).

VI. Additional Information

The copies of the applications, related documents, the fact sheet and the draft research permit are on file at the U.S. Environmental Protection Agency, Region 9, Oceans and Estuaries Section (W-5-3), 215 Fremont Street, San Francisco, California 94105 or the American Samoa Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa 96799. These documents may be inspected, and arrangements made for copying at a charge of $0.20 per copy sheet, at the above offices between 8:00 a.m. and 4:00 p.m., Monday through Friday.

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or

Susan Cox
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FACT SHEET

OCEAN DUMPING PERMIT OD 88-01 RESEARCH

STAR-KIST SAMOA, INC. AND SAMOA PACKING COMPANY, INC. PAGO PAGO, AMERICAN SAMOA

I. Summary

The U.S. Environmental Protection Agency (EPA) Region 9 has received complete applications from Star-Kist Foods, Incorporated and Ralston Purina Company, Incorporated for ocean disposal of fish processing wastes off Pago Pago, American Samoa. The applications were made on behalf of their subsidiaries, Star-Kist Samoa, Incorporated and Samoa Packing Company, Incorporated, respectively. In accordance with EPA's authority established in Sections 101 and 102 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) (33 U.S.C. 1401 *et seq.*), the Regional Administrator has tentatively decided to issue a joint research permit to the subsidiary companies for ocean disposal of fish processing wastes over a six month period.

The monitoring program included in the research permit has been revised from the one required in EPA Region 9's ocean dumping permits OD 86-01 and OD 87-01. The program is designed to identify potential sources of pollution from the plant waste streams, to ensure that American Samoa Water Quality Standards are not violated, and to determine whether ocean dumping is likely to unreasonably degrade or endanger human health or the marine environment. EPA Region 9 will not proceed with final approval of this research permit without public comment, or the concurrence of the American Samoa Government and other Federal agencies required under EPA's Ocean Dumping Regulations at 40 CFR 220 through 229.

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II. Description of the Proposed Project

A. Project Overview

The two fish canneries in American Samoa, Star-Kist Samoa and Samoa Packing Company, propose to ocean dispose of fish processing wastes at a dump site centered approximately 2.1 nautical miles south of Tutuila Island in 900 fathoms (5,400 feet or 1,800 meters) of water. The waste materials will be transported to the site and discharged at a rate less than or equal to 1400 gallons per minute at a maximum speed of 10 knots within a 0.2 nautical mile radius circle.

The receiving waters, at the above location, are classified as "oceanic" by the American Samoa Water Quality Standards. These waters are characterized by low values for turbidity, nitrogen, phosphorus and chlorophyll a; a high degree of light penetration; near saturation values for dissolved oxygen; and a wide range of pH values. Four hours after dumping has ceased, concentrations of the above parameters must return to the ambient levels (40 CRF 227.29) defined in the American Samoa Water Quality Standards. EPA Region 9 will evaluate potential impacts to water quality based on the data obtained from the reference site stipulated in the permit, and the American Samoa Water Quality Standards.

B. Location of Disposal Site

If the permit is issued, transportation for the purpose of ocean dumping would terminate at, and waste disposal would be confined to a circular area with a 1.5 nautical mile diameter centered at 14° 22' 11" South latitude by 170° 40' 52" West longitude.

III. EPA's Authority To Issue Ocean Dumping Permits

A. EPA's authority to issue ocean dumping permits is defined under Sections 101 and 102 of MPRSA and at 40 CFR 220.4. The authority to issue research permits was delegated to the regional offices on July 25, 1984.

B. Section 101(b) of MPRSA authorizes the Administrator to issue permits necessary to conduct research. Section 101(b)(3) directs that EPA shall consult with the Secretary of Commerce to ensure that the potential benefits of a research permit outweigh any potentially adverse impacts during the study period. This subsection also limits the period of a research permit to six months.

C. Section 102 of MPRSA gives EPA the authority to issue permits for disposal of wastes other than dredge material. A formal site designation does not have to occur in order to issue a research permit. Future long-term use of this site will depend upon evaluation of data generated during the previous research permits (OD 86-01 and OD 87-01), results of monitoring contained in this proposed permit, and the applicants' demonstration of need regarding ocean disposal.

IV. Tentative Decision and Summary of Factors Considered in Reaching the Permit Decision

Star-Kist Samoa and Samoa Packing Company have applied for an Ocean Dumping Permit to dispose of their fish cannery wastes near Pago Pago, American Samoa. EPA Region 9 is planning to grant their application by issuing them a research ocean dumping permit for a period of six months.

Information developed during the permit period plus data from the previous permits (OD 86-01 and OD 87-01) will be used to determine whether dumping on a more permanent basis would unreasonably degrade or endanger human health, the marine environment, ecological systems or economic potentialities [33 U.S.C. 1412a(1)(B)]. The permittees will be required to conduct a revised EPA Region 9-approved site monitoring program, including laboratory analyses, to document that environmental impacts in the ocean will not be unreasonable and that American Samoa Water Quality Standards will be met. This information will be used to augment EPA's efforts to formally designate an ocean disposal site according to the agency's voluntary environmental impact statement policy for ocean disposal site designation (39 FR 37119, October 24, 1974), and to issue a special ocean dumping permit under 40 CFR 227, if appropriate.

The scale of the proposed dumping during the research period is expected to have minimal adverse impact on human health and/or the environment. While data gathered during the course of this permit will be used to confirm the absence of unreasonable adverse effects from the discharge of fish wastes adulterated with alum and a coagulant polymer, the existing data indicate that impacts at the site should be minimal. The primary environmental impact of the proposed discharges would be short-term increases in turbidity, inorganic nutrients, biological oxygen demand and ammonia during the dumping event. Preliminary scientific studies of ocean disposal of dissolved air flotation (DAF) sludge in American Samoa indicate that water quality parameters should return to ambient conditions following the period of initial mixing after an ocean dumping event (40 CFR 227.29). To ensure that American Samoa Water Quality Standards are not exceeded after the period of initial mixing, restrictive disposal rates and limitations on the waste material constituents are defined in the permit. Hence, EPA believes that the benefit of assessing the impact of the discharging fish cannery wastes outweighs any adverse impact that may occur as a result of permitting the discharge for six months.

V. Terms of the Proposed Permit

A. Description of Waste Material

During the term of the research permit, and in accordance with all other terms and conditions of the permit, the permittees would be authorized to transport for disposal into ocean waters quantities of waste material that shall not exceed the following amounts:

Waste Material	Star-Kist Samoa (gallons/day)	Samoa Packing Co. (gallons/day)	Total Permitted Discharge (gallons/day)
DAF Sludge	60,000	31,400	91,400
Precooker Water	100,000	13,300	113,300
Press Water	40,000	12,200	52,200
Total Maximum Daily Volume	200,000	56,900	256,900

B. Waste Material Limitations in the Proposed Permit

1. The Permitted Maximum Concentrations were determined based on historical data and data gathered by the applicants during the past two research permits. The maximum concentrations of Total Nitrogen, Total Phosphorus and Oil and Grease have been reduced for DAF sludge based upon an analysis of the monitoring results.

Fish Processing Waste Material	Total Permitted Daily Volume To Be Dumped	Permitted Maximum Concentration Per Constituent	
DAF Sludge[a]	91,400 gal/day	Tot. Sus. Solids	219,000 mg/L
		BOD_5	269,000 mg/L
		Total Phosphorus	2,500 mg/L
		Total Nitrogen	15,000 mg/L
		Oil and Grease	100,000 mg/L
Precooker Water[b]	113,300 gal/day	Tot. Sus. Solids	65,000 mg/L
		BOD_5	82,100 mg/L
		Total Phosphorus	1,160 mg/L
		Total Nitrogen	9,930 mg/L
Press Water[b]	52,200 gal/day	Tot. Sus. Solids	285,000 mg/L
		BOD_5	144,200 mg/L
		Total Phosphorus	3,810 mg/L
		Total Nitrogen	18,210 mg/L

a = Maximum Permitted Concentrations are assumed to be highest if the vessel contains waste material only from the Star-Kist Samoa plant. Concentrations listed for each of the waste materials were provided by Star-Kist Samoa.

b = Maximum limits provided by Star-Kist Foods on April 4, 1986.

2. The pH range for all waste material will be between 5.5 and 7.0 pH units.

3. The Permitted Maximum Concentration and pH limits, listed above, shall not be exceeded at any time during the term of this permit.

4. The permit requires that each permittee report the results of waste stream analyses for DAF sludge, press water and precooker water because these materials were identified in the permit applicantion for disposal (see Introduction to Special Condition 3).

5. Detection limits have been specified for all analytical parameters (see Special Condition 3.1.2).

6. The American Samoa Government asked that they be given the responsibility to permit the disposal of grit. This was determined to be acceptable to EPA, and the reporting of grit was deleted in research permit OD 87-01.

7. EPA has determined that the requirement for analysis of PCBs and pesticides contained in OD 87-01 will not be continued. The levels reported by the canneries were found to be consistently nondetectable.

C. Changes in the Monitoring Program

1. Monitoring cruises may be scheduled from Monday through Sunday.

2. The permittees are required to submit the qualifications of the Principal Investigator in charge of the field monitoring operations at the disposal site (see Special Condition 5.4.2).

3. The locations of transmissivity profile sampling stations were changed slightly to allow the permittees to monitor the disposal plume more accurately. The Principal Investigator will visually locate the plume and ensure that the first profile is taken in the middle of the plume. Additional profiles, reduced by two for Stations 3 through 7, shall be taken at points 90° and 270° relative to the plume (see Appendix A, Section 7.1)

4. Requirements for plume/drogue tracking proposed in the tentative decision for permit OD 87-01 were deleted for the final permit in favor of the transmissivity profile monitoring technique.

5. The maximum depth at which samples will be taken is 20 meters (see Sections 7.1.6 and 7.2.3).

6. Detection limits have been specified for all parameters to be sampled (see Sections 7.1.6 and 7.2.5).

7. EPA received the summary report for bioassays conducted during research permit OD 86-01 and no further bioassays will be required for this permit.

8. Permit reporting was substantially strengthened and highlighted in permit OD 87-01 as a very important part of permit compliance (see General Condition 1.2.3 and Special Conditions 3.3.2, 3.3.3, 4.6.1, 5.2, 5.3.2, 5.4). EPA continues to emphasize that these requirements must be met during the term of this permit. Copies of the summary reports will also be sent to the National Marine Fisheries Service (see Special Condition 6.2.4).

VI. Administrative Procedures

A. The processing of an ocean dumping permit consists of the following actions:

1. EPA receives a completed application (40 CFR 221).

2. EPA issues a tentative decision whether to grant or deny the research permit (40 CFR 222.2). A draft permit is the means by which EPA documents the intent to grant an ocean dumping permit.

3. A public notice is issued to announce EPA's intent to issue the permit (40 CFR 222.3). The notice contains the following elements: summary, tentative determination, hearing process, factors considered in reaching the tentative determination and the location of all information on the draft permit. Public notices describing EPA's intent to issue a permit are published in a daily newspaper in closest proximity to the proposed dump site and in a daily newspaper in the city in which EPA's regional office is located.

4. Before a final decision can be made on the research permit, formal consultation must be documented with the following agencies: American Samoa Government, U.S. Army Corps of Engineers, U.S. Coast Guard, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Shellfish Sanitation Branch of the Food and Drug Administration.

B. Initiation of a Public Hearing

1. Within 30 days of the date of the public notice, any person may request a public hearing to consider issuance or denial of the research permit or conditions to be imposed upon this permit. Any request for a hearing must be made in writing; must identify the person requesting the hearing; and must clearly state any objections to issuance or denial of the permit or to the conditions to be imposed upon the permit, and the issues to be considered at the hearing. In accordance with 40 CFR 222.4, the Regional Administrator may schedule a hearing, at his discretion, based on genuine issues presented in the written request or the necessity to hold a public hearing.

2. Upon receipt of a written request presenting genuine issues amenable to resolution by a public hearing, the Regional Administrator determines a time and place for the hearing and publishes a notice of the hearing. All interested parties are invited to be present or represented at the hearing to express their views on the proposed issuance or denial of the permit. If a request for a public hearing is made within 30 days of the date of this notice and does not meet the above criteria, the Regional Administrator must advise the requesting person in writing and proceed to rule on the application.

3. Following adjournment of the public hearing, the Presiding Officer, appointed by the Regional Administrator, prepares written recommendations relating to the issuance, denial or conditions to be imposed upon the permit after full consideration of the views and arguments expressed at the hearing (40 CFR 222.6 to 222.8). The Presiding Officer's recommendations and the record of the hearing are forwarded to the Regional Administrator within 30 days of the hearing.

4. The Regional Administrator makes a determination whether to issue, deny or impose conditions on the permit within 30 days of receipt of the Presiding Officer's recommendations. He must give written notice of the decision to any person registered at the public hearing (40 CFR 222.9).

5. A final permit becomes effective 10 days after issuance, if no requests for an adjudicatory hearing are received. Requests for an adjudicatory hearing may be made within 10 days of receipt of the notice to issue or deny the permit (40 CFR 222.10 to 222.11). An appeal of the adjudicatory hearing decision may be made in writing to the Administrator within 10 days following receipt of the Regional Administrator's determination on the adjudicatory hearing (40 CFR 222.12).

VI. Additional Information

The copies of the applications, related documents, the fact sheet and the draft research permit are on file at the U.S. Environmental Protection Agency, Region 9, Oceans and Estuaries Section (W-7-1), 215 Fremont Street, San Francisco, California 94105 or the American Samoa Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa 96799. These documents may be inspected, and arrangements made for copying at a charge of $0.20 per copy sheet, at the above offices between 8:00 a.m. and 4:00 p.m., Monday through Friday.

For further information on the research permit or questions pertaining to MPRSA regulations, please contact:

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U.S. EPA Region 9
Oceans and Estuaries Section
(W-7-1)
215 Fremont Street
San Francisco, CA 94105
(415) 974-0257

or

Susan Cox
U.S. EPA Region 9
Office of Pacific Island and Native American Programs
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215 Fremont Street
San Francisco, CA 94105
(415) 974-7432

FACT SHEET
OCEAN DUMPING PERMIT OD 88-02 RESEARCH
STAR-KIST SAMOA, INC. AND SAMOA PACKING COMPANY, INC.
PAGO PAGO, AMERICAN SAMOA

I. Summary

The U.S. Environmental Protection Agency (EPA) Region 9 has received complete applications from Star-Kist Foods, Incorporated and Van Camp Seafood Company, Incorporated for ocean disposal of fish processing wastes off Pago Pago, American Samoa. The applications were made on behalf of their subsidiaries, Star-Kist Samoa, Incorporated and Samoa Packing Company, Incorporated, respectively. In accordance with EPA's authority established in Sections 101 and 102 of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) (33 U.S.C. 1401 et seq.), the Regional Administrator has tentatively decided to issue a joint research permit (OD 88-02) to the subsidiary companies for ocean disposal of fish processing wastes over a six month period.

Permit conditions for OD 88-02 and the monitoring program are the same as those for EPA Region 9's ocean dumping permit OD 88-01. The program is designed to identify potential sources of pollution from the plant waste streams, to ensure that American Samoa Water Quality Standards are not violated, and to determine whether ocean dumping is likely to unreasonably degrade or endanger human health or the marine environment. EPA Region 9 will not proceed with final approval of this research permit without public comment, or the concurrence of the American Samoa Government and other Federal agencies required under EPA's Ocean Dumping Regulations at 40 CFR 220 through 229.

The draft research permit and the administrative record are available for public review at EPA's Regional Office, 215 Fremont Street, San Francisco, California and the Environmental Quality Commission, Office of the Governor, Pago Pago, American Samoa. The administrative record sets forth the principal facts and the significant legal, methodological and policy questions considered in the development of the research permit.

II. Description of the Proposed Project

A. Project Overview

The two fish canneries in American Samoa, Star-Kist Samoa and Samoa Packing Company, propose to ocean dispose of fish processing wastes at a dump site centered approximately 2.1 nautical miles south of Tutuila Island in 900 fathoms (5,400 feet or 1,800 meters) of water. The waste materials will be transported to the site and discharged at a rate less than or equal to 1400 gallons per minute at a maximum speed of 10 knots within a 0.2 nautical mile radius circle.

The receiving waters, at the above location, are classified as "oceanic" by the American Samoa Water Quality Standards. These waters are characterized by low values for turbidity, nitrogen, phosphorus and chlorophyll a; a high degree of light penetration; near saturation values for dissolved oxygen; and a wide range of pH values. Four hours after dumping has ceased, concentrations of the above parameters must return to the ambient levels (40 CFR 227.29) defined in the American Samoa Water Quality Standards. EPA Region 9 will evaluate potential impacts to water quality based on the data obtained from the reference site stipulated in the permit, and the American Samoa Water Quality Standards.

B. Location of Disposal Site

If the permit is issued, transportation for the purpose of ocean dumping would terminate at, and waste disposal would be confined to the center of a circular area with a 1.5 nautical mile diameter centered at 14° 22' 11" South latitude by 170° 40' 52" West longitude.

III. EPA's Authority To Issue Ocean Dumping Permits

A. EPA's authority to issue ocean dumping permits is defined under Sections 101 and 102 of MPRSA and at 40 CFR 220.4. The authority to issue research permits was delegated to the Regional Administrator on July 25, 1984.

B. Section 101(b) of MPRSA authorizes the Regional Administrator to issue permits necessary to conduct research. Section 101(b)(3) directs that EPA shall consult with the Secretary of Commerce to ensure that the potential benefits of a research permit outweigh any potentially adverse impacts during the study period. This subsection also limits the period of a research permit to six months.

C. Section 102 of MPRSA gives EPA the authority to issue permits for disposal of wastes other than dredge material. A formal site designation does not have to occur in order to issue a research permit. Future long-term use of this site will depend upon evaluation of data generated during the previous dumping permits (including: OD 79-01, OD 79-02, OD 86-01, OD 87-01 and OD 88-01), results of monitoring contained in this proposed permit, the applicants' demonstration of need regarding ocean disposal and formal evaluation of alternative disposal methods in an environmental impact statement.

IV. Tentative Decision and Summary of Factors Considered in Reaching the Permit Decision

On June 28, 1988 Star-Kist Samoa and Samoa Packing Company applied for an Ocean Dumping Permit to dispose of their fish cannery wastes near Pago Pago, American Samoa. EPA Region 9 is planning to grant their application by issuing them a research ocean dumping permit for a period of six months.

Information developed during the permit period plus data from the previous permits will be used to determine whether dumping on a more permanent basis would unreasonably degrade or endanger human health, the marine environment, ecological systems or economic potentialities [33 U.S.C. 1412a(1)(B)]. The permittees will be required to conduct an EPA Region 9-approved site monitoring program, including field and laboratory analyses. Results of the monitoring program will be used to document that unacceptable environmental impacts are not occurring in the ocean and that the dumping complies with American Samoa Water Quality Standards. This information will be used to augment EPA's efforts to formally designate an ocean disposal site according to the agency's voluntary environmental impact statement policy for ocean disposal site designation (39 FR 37119, October 24, 1974), and to issue a special ocean dumping permit under 40 CFR 227, if appropriate.

The scale of the proposed dumping during the research period is expected to have minimal adverse impact on human health and/or the environment, as demonstrated by the monitoring results of the previous permits. While data gathered during the course of OD 88-02 will be used to confirm the absence of unreasonable adverse effects from the discharge of fish wastes adulterated with alum and a coagulant polymer, the existing data indicate that impacts at the site are minimal. The primary environmental impact of the proposed discharges would be short-term increases in turbidity, inorganic nutrients, biological oxygen demand and ammonia during the dumping events.

Preliminary scientific studies of ocean disposal of dissolved air flotation (DAF) sludge in American Samoa indicate that water quality parameters should return to ambient conditions following the four hour period of initial mixing after an ocean dumping event (40 CFR 227.29). To ensure that American Samoa Water Quality Standards are not exceeded after the period of initial mixing, restrictive disposal rates and limitations on the waste material constituents are defined in the permit. Hence, EPA believes that the benefit of assessing the impact of the discharging fish cannery wastes outweighs any adverse impact that may occur as a result of permitting the discharge for six months.

V. Terms of the Proposed Permit

In general, research permit OD 88-02 is the same as the final revisions to OD 88-01. The permittees have been disposing of fish cannery wastes and successfully monitoring the waste streams and the disposal site according to the specifications of the present permit.

A. Description of Waste Material

During the term of the research permit, and in accordance with all other terms and conditions of the permit, the permittees would be authorized to transport for disposal into ocean waters quantities of waste material that shall not exceed the following amounts:

Waste Material	Star-Kist Samoa (gallons/day)	Samoa Packing Co. (gallons/day)	Total Permitted Discharge (gallons/day)
DAF Sludge	60,000	31,400	91,400
Precooker Water	100,000	13,300	113,300
Press Water	40,000	12,200	52,200
Total Maximum Daily Volume	200,000	56,900	256,900

B. Waste Material Limitations in the Proposed Permit

The Permitted Maximum Concentrations were determined based on historical data and data gathered by the applicants during the past two research permits.

Fish Processing Waste Material	Total Permitted Daily Volume To Be Dumped	Permitted Maximum Concentration Per Constituent	
DAF Sludge[a]	91,400 gal/day	Tot. Sus. Solids	219,000 mg/L
		BOD_5	269,000 mg/L
		Total Phosphorus	2,500 mg/L
		Total Nitrogen	15,000 mg/L
		Oil and Grease	100,000 mg/L
Precooker Water[b]	113,300 gal/day	Tot. Sus. Solids	65,000 mg/L
		BOD_5	82,100 mg/L
		Total Phosphorus	1,160 mg/L
		Total Nitrogen	9,930 mg/L
Press Waterb	52,200 gal/day	Tot. Sus. Solids	285,000 mg/L
		BOD_5	144,200 mg/L
		Total Phosphorus	3,810 mg/L
		Total Nitrogen	18,210 mg/L

a = Maximum Permitted Concentrations are assumed to be greatest if the vessel contains waste material only from the Star-Kist Samoa plant. Concentrations listed for each of the waste materials are based on historical information and data provided by the applicants.

b = Maximum limits provided by Star-Kist Foods on April 4, 1986.

VI. <u>Administrative Procedures</u>

A. The processing of an ocean dumping permit consists of the following actions:

1. EPA receives a completed application (40 CFR 221).

2. EPA issues a tentative decision whether to grant or deny the research permit (40 CFR 222.2). A draft permit is the means by which EPA documents the intent to grant an ocean dumping permit.

3. A public notice is issued to announce EPA's intent to issue the permit (40 CFR 222.3). The notice contains the following elements: summary, tentative determination, hearing process, factors considered in reaching the tentative determination and the location of all information on the draft permit. Public notices describing EPA's intent to issue a permit are published in a daily newspaper in closest proximity to the proposed dump site and in a daily newspaper in the city in which EPA's regional office is located.

4. Before a final decision can be made on the research permit, formal consultation must be documented with the following agencies: American Samoa Government, U.S. Army Corps of Engineers, U.S. Coast Guard, National Marine Fisheries Service, U.S. Fish and Wildlife Service and the Shellfish Sanitation Branch of the Food and Drug Administration.

B. Initiation of a Public Hearing

1. Within 30 days of the date of the public notice, any person may request a public hearing to consider issuance or denial of the research permit or conditions to be imposed upon this permit. Any request for a hearing must be made in writing; must identify the person requesting the hearing; and must clearly state any objections to issuance or denial of the permit or to the conditions to be imposed upon the permit, and the issues to be considered at the hearing. In accordance with 40 CFR 222.4, the Regional Administrator may schedule a hearing, at her discretion, based on genuine issues presented in the written request or the necessity to hold a public hearing.

2. Upon receipt of a written request presenting genuine issues amenable to resolution by a public hearing, the Regional Administrator determines a time and place for the hearing and publishes a notice of the hearing. All interested parties are invited to be present or represented at the hearing to express their views on the proposed issuance or denial of the permit. If a request for a public hearing is made within 30 days of the date of this notice and does not meet the above criteria, the Regional Administrator must advise the requesting person in writing and proceed to rule on the application.

3. Following adjournment of the public hearing, the Presiding Officer, appointed by the Regional Administrator, prepares

written recommendations relating to the issuance, denial or conditions to be imposed upon the permit after full consideration of the views and arguments expressed at the hearing (40 CFR 222.6 to 222.8). The Presiding Officer's recommendations and the record of the hearing are forwarded to the Regional Administrator within 30 days of the hearing.

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VII. Additional Information

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For further information on the research permit or questions pertaining to MPRSA regulations, please contact:

Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA Region 9
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215 Fremont Street
San Francisco, CA 94105
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United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307

MAR 17 1987

Mr. Patrick Cotter
Oceans and Estuaries Section (W-5-3)
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, CA 94105

Re: Notice of Intent for Fish Cannery Wastes Off Pago Pago, American Samoa

Dear Mr. Cotter:

We have reviewed the subject Notice of Intent and have no specific comments to offer at this time. Generally, we encourage the proposed action and its ancillary scientific monitoring program, as an environmentally prudent alternative to the current method of cannery waste disposal. Our principal concern which should be discussed in the Environmental Impact Statement is the fate of floatable material and fish oils which may form a surface slick and subsequently wash ashore under certain weather conditions.

We appreciate this opportunity to comment.

Sincerely yours,

William R Kramer

for Ernest Kosaka
Project Leader
Office of Environmental Services

cc: RO, FWS, R1 (AFWE)
ES/BEC, Wash DC
NMFS - WPPO
ASG Marine Resources
ASG CRM
ASG Development Planning Office

V.B. EVIDENCE OF CONSULTATION

The following persons or organizations were consulted personally during preparation of the Draft EIS:

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V.C. REQUESTED REVIEWERS

Permittees - Fish Waste

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American Samoa

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Executive Vice President
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Mr. William Herlong
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Pacific Legal Foundation
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Other Reviewers

Mr. David Itano
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Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
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Ms. Caroline Sinavaiana
President
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Pago Pago, American Samoa 96799

V.D. RESPONSE TO COMMENTS ON THE DRAFT EIS

Letters of comment were received on the Draft Environmental Impact a Statement. These are included in the following pages along with the responses to the items addressed.

1.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
Washington DC 20204

September 15, 1988

Janet Hashimoto
Chief, Oceans and Estuaries Section
U.S. Environmental Protection Agency
Region IX
215 Fremont Street
San Francisco, CA 94105

Dear Ms. Hashimoto:

Thank you for the time spent in sending this publication to our office. However, we would like to discontinue receiving the publications. 1-1

Mr. David Clem has retired and is no longer the Chief of the Shellfish Sanitation Branch, Mr. David M. Dressel is the new Chief of this branch. 1-2

Thanks again, if you have any questions please phone us at (202) 485-0149.

Sincerely yours,

Monica Bullard

Monica L. Bullard
Secretary
Shellfish Sanitation Branch
Center for Food Safety and
Applied Nutrition

RESPONSES TO COMMENTS BY THE DEPARTMENT OF HEALTH AND HUMAN SERVICES, FOOD AND DRUG ADMINISTRATION

Comment 1-1:

Comment noted; no response necessary.

Comment 1-2:

Change in Chief noted.

2.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

SEP 15 1988

Ms. Janet Hashimoto, Chief
Oceans and Estuaries Section
U.S. Environmental Protection Agency
215 Fremont Street
San Francisco, CA 94105

Re: Distribution of Environmental Impact Statements (EIS) to Pacific Islands Office, U.S. Fish and Wildlife Service

Dear Ms. Hashimoto:

We received two copies of your draft EIS for the Designation of an Ocean Site off Tutuila Island, American Samoa for Fish Processing Wastes; one addressed to Allan Marmelstein, Pacific Islands Administrator, and the other to Ernest Kosaka, Field Supervisor, Environmental Services.

Please delete EIS distribution to the Pacific Islands Administrator. We are under one administration, and EIS comments will be provided from the Office of Environmental Services. Enclosed is an extra copy of the draft EIS for your disposition. 2.1

Sincerely,

for
Ernest Kosaka
Field Supervisor
Environmental Services

Enclosure

RESPONSE TO COMMENTS BY THE FISH AND WILDLIFE SERVICE PACIFIC ISLANDS OFFICE U.S. DEPARTMENT OF INTERIOR

Comment 2-1:

Comment noted; mailing list will be revised.

3.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, CA 90731

October 19, 1988 F/SWR13:JJN

Mr. Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA, Region 9 (W-7-1)
215 Fremont Street
San Francisco, CA 94105

Dear Mr. Cotter:

The NOAA Fisheries, Southwest Region has reviewed the Draft Environmental Impact Statement (DEIS) for Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes.

In order to provide as timely a response to your request for comments as possible, we are submitting the enclosed comments to you directly, in parallel with their transmittal to the Department of Commerce for incorporation in the Departmental response. These comments represent the views of the Southwest Region. The formal, consolidated views of the Department should reach you shortly.

Sincerely yours,

E.C. Fullerton
E.C. Fullerton
Regional Director

cc: F/SWR13, Naughton

3 (cont.)

NOAA Fisheries, Southwest Region DEIS Comments

The Draft Environmental Impact Statement (DEIS), Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes, has been received by the NOAA Fisheries, Southwest Region for review and comment. The statement has been reviewed and the following comments are offered for your consideration.

General Comments

We were consulted during the planning stages of the proposed project, including establishment of the Research Ocean Dumping Permits (OD 86-01, OD 87-01, OD 88-01 and 02) and development of the DEIS. Consequently, resources for which we bear a responsibility and alternatives to reduce adverse impacts on these resources have for the most part been addressed to our satisfaction in the DEIS. 3-1

Although a preferred alternative is not selected in the DEIS, the information presented clearly indicates that all land based alternatives and the shallow water dumpsite should be eliminated from further consideration. Ocean disposal is presently the only viable alternative for disposal of the cannery wastes with the preferred alternative selection limited to either the present ocean dumpsite (B) or the deeper water dumpsite (D). 3-2

Information generated thus far during monitoring for the Research Ocean Dumping Permits at the present site (B) and the nearby former site (A) reveals no documented evidence that ocean dumped wastes have reached the fringing reefs or shoreline of Tutuila Island. In fact previous studies have not identified any adverse impacts from ocean disposal at the present site between 1980 to 3-3
1986.

However, in discussions with personnel from the Office of Marine Resources in American Samoa, it was learned that the ocean dumped waste plume has been observed on occasion to impact the fringing reef in the Tafuna area near the existing airport. In addition, the waste plume has been observed in surface waters surrounding the Fish Aggregation Device (FAD) moored off Steps Point west of the present dump site. Clearly, additional monitoring is needed to ensure that the waste plume does not impact habitat of importance to fishery resources, particularly nearshore reef 3-4
areas.

Despite the increased difficulty in conducting field monitoring and the additional transport distance, we believe the deep water site should be designated the preferred alternative if there is 3-5
any chance in the future of increasing the quantities of waste to

3 (cont.)

be dumped. The present dump site should be considered as the preferred alternative only if there is no anticipation of increasing the quantities of waste to be dumped, and if it can be clearly demonstrated that the existing plume will not impact shallow water habitats during any and all weather and oceanographic conditions. 3-5

Specific Comments

Chapter III. AFFECTED ENVIRONMENT
III.C.6. MARINE MAMMALS
Page III-95, paragraph 2. In this paragraph discussing humpback whales in waters off the Samoan Islands, the statement is made that "adults may move into deeper water at night to feed on squid". Humpbacks are not known to feed on squid and in fact are not believed to feed at all during the breeding season in warm tropical waters. 3-6

Chapter IV. ENVIRONMENTAL CONSEQUENCES
Table IV.1-3.
Pages IV-2 to 6. This table summarizes impacts and mitigation measures for the various dump site alternatives. We are concerned the table is an over-simplification and somewhat misleading. Many of the Class IV impacts (beneficial impacts) for the present site should be the same for the deeper water alternative. For example, if dumped cannery waste enhances productivity at the present site, then it should likewise do the same at the deeper site, therefore conceivably enhancing such listed categories as plankton, pelagic fish, pelagic invertebrates, and coastal birds at the deep water site as well. 3-7

RESPONSES TO COMMENTS FROM NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Comment 3-1:

Comment noted; no response needed.

Comment 3-2:

Correct. In the FEIS, the deeper water site has been selected as the preferred alternative of the two sites. See Summary, Chapter II, Alternatives et seq.

Comment 3-3:

Comment noted; no response necessary.

Comment 3-4:

The preferred site is farther from reefs and the FAD device to avoid impacting them. A new monitoring program will be part of the permit to be issued. In addition, observers of the plume should document location, date, time, wind and current conditions and report same to the ASG EQC office or the Coast Guard office.

Comment 3-5:

The deeper water site has been selected by EPA as the preferred alternative based on input from public agencies consultants and the public.

Comment 3-6:

The statement has been deleted since there seems to be differences of opinion among scientists.

Comment 3-7:

Consensus is that benefits which might accrue at the present site would also accrue at the deeper water site, regardless of the greater distance from shore. The tables have been modified and placed at the end of the discussion to ameliorate possible over-simplification due to condensing information into table format.

4.

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

October 25, 1988

REPLY TO
ATTENTION OF:
Planning Branch

Ms. Janet Hashimoto, Chief
Oceans and Estuaries Section
United States Environmental
Protection Agency, Region IX
215 Freemont Street
San Francisco, California 94105

Dear Ms. Hashimoto:

Thank you for the opportunity to review the Draft Environmental Impact Statement for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes. We have no comments on the document. 4-1

Sincerely,

Kisuk Cheung
Chief, Engineering Division

RESPONSE TO COMMENTS FROM THE U.S. ARMY ENGINEER DISTRICT, HONOLULU, DEPARTMENT OF THE ARMY

Comment 4-1:

Comment noted; no response needed.

The Chief Scientist
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

October 25, 1988

Mr. Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA, Region 9 (W-7-1)
215 Fremont Street
San Francisco, California 94105

Dear Mr. Cotter:

This is in reference to your Draft Environmental Impact Statement for Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes.

The comments you received from NOAA Fisheries, Southwest Region are the only comments you will receive from the National Oceanic and Atmospheric Administration or the Department of Commerce. 5-1

Thank you for giving us the opportunity to review your document.

Sincerely,

David Cottingham

David Cottingham
Ecology and Environmental
Conservation Office

RESPONSE TO COMMENTS FROM THE CHIEF SCIENTIST, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Comment 5-1:

Comment noted; no response needed

6.

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

October 27, 1988
RE:0510

✓Mr. Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA Region 9 (W-7-1)
215 Fremont Street
San Francisco, California 94105

Dr. Mr. Cotter:

Draft Environmental Impact Statement
Ocean Disposal Site for Fish Processing Waste
Tutuila Island, American Samoa

This document evaluates the environmental effects of ocean disposal of fish cannery wastes at three sites off Tutuila Island, American Samoa. The proposed action is to provide an environmentally acceptable alternative for the disposal of waste materials from the processing of fish at the Star-Kist Samoa Incorporated and Samoa Packing Company plants located at Aunu'u, on Pago Pago Harbor, Tutuila Island. The following comments reflect a limited review prepared with the assistance of Salvatore Comitini, Economics; and C. Anna Ulaszewski, Environmental Center.

We believe that this Draft Environmental Impact Statement (EIS) adequately explores the feasibility of the alternatives. "No action" and land disposal of waste materials are not viable alternatives due to severe adverse environmental and/or legal consequences which could force closure of the canneries. Furthermore, this would destroy an important sector of the economy which supports, directly and indirectly, about 40 percent of the labor force in the territory. 6-1

Ocean disposal, both from an environmental and socioeconomic perspective seems to be the least problematic alternative. The present site (as noted in Ocean Dumping Permit OD86-1) may provide potentially beneficial effects to subsistence fishing, recreational activities and sport fishing, due to the additional nutrients released at the site. The same can be said of the deeper site (located approximately 4.55 n miles off shore); however, the extra distance would significantly lengthen the daily trip time required of the dumping vessel and thus increase the costs 6-2

6. (cont.)

Mr. Patrick Cotter
October 31, 1988
Page 2

of disposal and monitoring costs. We do concur with the Draft EIS (p. S-7) that dumping at the shallower site south of Taema Bank may be detrimental to the coral reefs. (6-2 cont.)

We understand that no preferred site was selected in the Draft EIS. We hope our comments will be helpful in making that decision and in preparing the Final EIS. Thank you for the opportunity to comment on this Draft EIS.

Yours truly,

Jacquelin N. Miller

Jacquelin N. Miller
Associate Environmental Coordinator

cc: L. Stephen Lau
Salvatore Comitini
C. Anna Ulaszewski

RESPONSES TO COMMENTS FROM THE ENVIRONMENTAL CENTER, UNIVERSITY OF HAWAII AT MANOA

Comment 6-1:

Comment noted; no response necessary.

Comment 6-2:

The deeper water site has been selected by EPA in the FEIS and the center moved to a point 5.45 n mi from land to insure protection of the fringing reefs. The canners have indicated that the additional costs are acceptable for that reason. The new monitoring program is designed to take the increased distance into consideration.

7.

American Samoa Coastal Management Program
Economic and Development Planning Office
American Samoa Government
Pago Pago, American Samoa 96799
684-633-5155

AMERICAN SAMOA COASTAL MANAGEMENT PROGRAM

In reply refer to:

October 28, 1988

To: Patrick Cotter, Ocean Dumping Coordinator, U.S. EPA Region 9 (W-7-1), 215 Fremont Street, San Fransisco, California.

From: Henry Sesepasara, Program Manager, American Samoa Coastal Management Program, Development Planning Office, Pago Pago, American Samoa.

Subject: Draft Environmental Impact Statement for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes.

The American Samoa Coastal Management Program (ASCMP) have reviewed the DEIS for the above-mentioned project and offer the following comments:

1. Some local government officials and local fishermen have witness that the fish processing wastes dumped at the present site were seen moved closer toward the shoreline (Pago Pago International Airport side) at some times. Some of the residents of the Nu'uuli village complained that they can smell the fish wastes sometimes when the trade-winds from the east were strong.

   The ASCMP recommends that the dump site be moved further out to a deeper water at about five (5) miles from the Pago Pago Harbor. This should help eliminate any possibility of the fish wastes to be wash back toward the shoreline, and lessen any possibility for the notorious fish smell to the villages close to 7-1
   this area.

2. Quite often we heard reports that the vessel carrying the fish wastes do not quite make it to the dump site. Several citizens reported that the vessel dump the fish wastes closer to shore than they are required

   For this reason, it is recommended that an anchored buoy be located at the selected site to use as a visual mark. This will help the vessel for easy identification of the dump site, and also help for a wide monitoring of the vessel by not only the responsible 7-2
   government agency, but also by the public.

7. (cont.)

2

I hope that you consider these comments during your preparation of the Final Environment Impact Statement. For any additional information from ASCMP, please contact myself directly or my assistant, Richard Volk, at 684-633-5155.

Henry Sesepasara, Program Manager

RESPONSES TO COMMENTS BY THE AMERICAN SAMOA COASTAL MANAGEMENT PROGRAM, AMERICAN SAMOA GOVERNMENT

Comment 7-1:

The EPA has selected the deeper water site, with its' center moved to a point 5.45 n mi from land, as the preferred site, as discussed in the FEIS. The comments of public agencies, consultants and the public led to a consensus that this would better protect the reefs and shore.

Comment 7-2:

All logs required to be filed with ASG for permits OD 86-01, 87-01, 88-01 and 88-02 show that the vessel had reached the dumpsite. The permits required that the vessel go to the center of the site. The permit to be issued when the site is designated will require the vessel to go to 0.3 n mi within the upcurrent perimeter of the dumpsite to begin discharging.

Water is considered too deep at the deeper water site at 1500 fms to anchor a FAD buoy.

8.

VAN CAMP
SEAFOOD
COMPANY, INC.

October 28, 1988

Mr. Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA Region 9 (W-7-1)
215 Fremont Street
San Francisco, CA 94105

RE: Draft Environmental Impact Statement

Dear Mr. Cotter:

Samoa Packing Company offers the following comments regarding the Draft Environmental Impact Statement for the designation of an ocean disposal site off Tutuila Island, American Samoa for fish processing wastes.

1. Samoa Packing Company fully supports the designation of an ocean disposal site off Tutuila Island, American Samoa, and believes ocean disposal to be the only viable solution for the handling of cannery wastes. 8-1

2. Because the difficulties associated with going to a deeper water disposal site are significant and there are no real ecological advantages, the dumpsite presently being used should be the designated disposal site. 8-2

3. Extensive monitoring of the present dumpsite has indicated no adverse impact on the environment, but rather a possible favorable impact on the biomass there. Samoa Packing Company therefore supports the position that no further monitoring be required at this site. 8-3

Please advise if there are questions regarding any of the above or if additional information is required.

Sincerely,

SAMOA PACKING COMPANY

Fred H. Avers

Fred H. Avers
Vice President and Director
Production Operations

901 Chouteau Avenue St Louis, MO 63164
TELEX 44-7620 TWX 910-761-1192
FAX General Office (314) 982-1011 • Fax Sales Only (314) 982-2500

RESPONSE TO COMMENTS FROM SAMOA PACKING COMPANY

Comment 8-1:

Comment noted; no response needed.

Comment 8-2:

The deeper water preferred site is needed to protect fringing reefs and avoid disposal within the territorial waters of ASG. The added distance from shore permits increasing quantities within permit limits, whereas it would not be possible at the present site (See Appendix B, the model simulation).

Comment 8-3:

Monitoring will continue to be required by EPA for any permit. See the proposed site management plan (Appendix C), wherein the monitoring program is designed to take the added distance into consideration.

9.

Star-Kist Foods, Inc.

180 EAST OCEAN BOULEVARD
LONG BEACH, CALIFORNIA 90802-4797
(213) 590-7900

October 31, 1988

Mr. Patrick Cotter (W-7-1)
U.S. EPA Region IX
Marine And Wetlands Protection
215 Fremont Street
San Francisco, CA 94105

SUBJECT: **Comments To Draft Environmental Impact Statement for the Designation Of An Ocean Disposal Site - American Samoa**

Dear Mr. Cotter:

We have reviewed the Draft Environmental Impact Statement for designation of an ocean disposal site off Tutuila Island, American Samoa. We fully support designation of the presently operated site, which has been used continuously since late 1980, for disposal of these wastes. 9-1
We realize there has been some concern should high-strength waste be also dumped at the site relative to the potential for waste materials coming close to the shore line. In actuality, some of the high-strength wastes are now being ocean dumped by SAMPAC. The remainder of the high-strength wastes are co-mingled with other process waste waters before treatment with dissolved air flotation at the two canneries. Therefore, the sludge already contains the solids and oil and grease, that is presently being dumped at the site. Although there would be a significant increase in the volume of waste dumped per day at the present site, the pounds of oil and grease and solids would remain essentially unchanged. 9-2

Ocean dumping at the more distant alternative site would involve an increase in transit time to a location that is less protected than the present site from the effects of open ocean conditions. Therefore, the site would be unavailable during more days per year due to bad weather, and present a significant increase in hazard to both the disposal vessel crew and for those performing surveillance. There would also be an increase in fuel and other operating cost due to the longer transit time to the deeper site. We do not believe there is any significant benefit to the deeper site that warrants the increased risk and decreased availability. We, therefore, urge that the present site be designated as the permanent site. 9-3

JN5 PC1028

9. (cont.)

Extensive monitoring at the present site and background stations over a period of two years, as well as previous monitoring in 1982, have shown that ocean dumping of fish cannery waste materials is environmentally acceptable and biologically preferred to other disposal options. Monitoring has shown no instances of waste materials coming close to the shore line under various weather and current conditions, and there has been no indication of any adverse impact on the marine environment. 9-4

Following are some details that should be changed in the final EIS:

Page I-5, Second Paragraph: The sentence: "Today liquid wastes continue to flow into the harbor under NPDES permits". This refers to the fact that treated waste waters continue to be discharged into the harbor under valid permits. We would request the EIS be re-worded to indicated that those liquid wastes are treated before discharge. 9-5

Page V-33: Mr. David Ballands should be removed from the mailing list and be replaced by Danko Stambuk, Sr. Manager Seafood Engineering. 9-6

These are the official comments of Star-Kist Foods, Inc. and Star-Kist Samoa, Inc. to the Draft EIS. If we can provide any further information relative to this review or the project, please contact me at 213/590-3873.

Yours truly,

Jeffrey R. Naumann
Manager, Environmental Engineering

JRN/tkp

cc: Susan Cox - EPA IX of Territorial Program
Pati Faiai - ASG EQC
A. Crooley
R. Ward
R. Hetzler
D. Stambuk
J. Ciko - HJH Law Dept.
Fred Avers - Van Camp

JN5 PC1028

RESPONSES TO COMMENTS FROM STAR-KIST FOODS

Comment 9-1:

The deeper water site has been selected by EPA to protect the fringing reefs and the quality of the territorial waters.

Comment 9-2:

The increase in total volume expected to be discharged represents an increase in the size, and therefore the distribution, of the plume. It is not possible to increase the volume at the present site without possible contamination of the reefs by the plume.

Comment 9-3:

See comment 9-2. It is to the canners' advantage to be able to increase the quantities of waste dumped, within permit limits. This cannot be done at the present site.

Comment 9-4:

Comment noted; no response needed.

Comment 9-5:

The text is revised to so indicate.

Comment 9-6:

The mailing list is being revised as indicated.

10a.

AMERICAN SAMOA GOVERNMENT
PAGO PAGO, AMERICAN SAMOA 96799
OFFICE OF THE GOVERNOR
ENVIRONMENTAL PROTECTION AGENCY

In reply refer to

October 31, 1988

Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA Region 9 (W-7-1)
215 Fremont Street
San Francisco, CA 94105

Dear Mr. Cotter:

My agency has reviewed the draft Environmental Impact Statement (DEIS) for designation of a disposal site for fish processing wastes in American Samoa. Attached are also a set of comments from the Department of Marine and Wildlife Resources in American Samoa and the local environmental group, Le Vaomatua. Our comments are the following:

1. Prior to final designation of the ocean dump site, a water quality certification from the American Samoa Environmental Quality Commission (EQC) must be obtained in accordance with the Clean Water Act. A consistency certification from the American Samoa Coastal Management Program is also required. 10a-1

2. The DEIS made the conclusion on page V-16 that impacts due to coagulant polymer at the site should be minimal, but no discussion of coagulant polymer is present in the DEIS. 10a-2

3. The DEIS assumes the Azumu Maru is the boat to be used for ocean dumping and makes predictions based on this. A new boat, the Mataora, is now utilized which has some characteristics that may differ from the Azumu Maru and could affect the predictions contained in the DEIS. 10a-3

10a (cont.)

Patrick Cotter
Page -2-

4. The present ocean dumping site is identified in several places in the DEIS as the preferred alternative, but justification for this was not provided in the DEIS. This determination seems premature when questions such as those listed on page IV-22 under IV.C.5.a. <u>Choices</u> are included in the document. 10a-4

5. On page I-5 of the DEIS, it is stated that "Removal of all wastes may result in a significant decrease in the harbor biota:" There is little evidence to support this statement. The inputs from the canneries over time have led to significant degradation of harbor water quality. Harbor organisms and ecology may have adapted to these changes, and removal of the inputs could interrupt the present biotic community. There might be a decrease in harbor biota, but this is necessary to return harbor conditions to those similar to its former state. 10a-5

6. On page I-5 of the DEIS, it states that large quantities of trash and vegetation are flushed into the harbor. The American Samoa Government (ASG) provides for solid waste removal from residences and businesses on a routine basis. While trash and vegetation do reach Pago Pago harbor, dumping of refuse into streams and the harbor is not the general practice in the community. 10a-6

7. On page I-23, the EQC rules on permitting for water discharges is discussed. These rules have been changed such that the EQC will consult with the U.S. EPA, Coast Guard and Public Health Division prior to permit issuance. The rule stating that no permit can be issued when U.S. EPA, the Coast Guard, or the Army Corps of Engineers objects has been deleted. Also, this permit system does apply to ocean dumping. It has been the practice of the EQC to rely on the federal programs for National Pollutant Discharge Elimination System (NPDES) for major facilities and ocean dumping. The EQC provides its input through review of draft permits and providing water quality certifications to U.S. EPA on these permits. 10a-7

8. The DEIS states on page II-2 that the total volume of wastes may be increased in the future above the amounts of DAF sludge. It is very likely that this will occur. The NPDES permits for these facilities contains a compliance schedule requiring that the canneries meet permit limitations by March, 1988 related to removal of high strength wastes from the harbor discharge. The only alternative for disposal of these wastes at this time is ocean dumping. The DEIS should be based on discharge of these wastes at the ocean dump site and on any possible impacts. The canneries have not yet begun discharge of these wastes at the ocean dump site, but this will likely begin upon resolution of the evidentiary hearing requested by the canneries on the NPDES requirements. 10a-8

10a (cont.)

Patrick Cotter
Page -3-

9. On page II-14, it states that the present site provides adequate distance from shore to prevent fouling of the fringing reefs. My office has received reports of diluted sludge being washed up or near shore a number of times. This indicates that this site may be too close to shore of Tutuila Island. 10a-9

10. On page II-19, it states that a separate EIS is in preparation for the liquid wastes that may be discharged at the dump site. A study has been undertaken to determine alternatives for disposal of these wastes, but it is not an EIS and does not follow the EIS format. The disposed of the liquid wastes and oceans dumping of the sludge are not issues that should reviewed separately. 10a-10

11. On page III-25, it states that complaints on odor and wastes coming ashore have not been voiced. This is not necessarily true. My office has received such complaints, both written and verbal. 10a-11

12. The DEIS addresses air impacts, but does not contain information on local air quality standards nor was the study entitled "Air Emission Inventory for American Samoa." 10a-12

13. It states the municipal wastes sometimes collect in Vai Cove on page III-43. While this is the location of the Tafuna Sewage Treatment Plant outfall, it is not documented that municipal wastes collect there. The DEIS does not describe the type of municipal waste. The effluent from the treatment plant receives adequate dilution in this area. 10a-13

14. On page III-53, calculations that show the waste field will be dispersed prior to reaching shore are referred to, but the location of these calculations is not provided. 10a-14

15. The DEIS does not discuss American Samoa Water Quality Standards (WQS), whether these are presently met, and if they will be met in the long term for either proposed site. 10a-15

16. The DEIS does not fully discuss the sludge characteristics as determined through the testing required in the recent Ocean Dumping Research Permits. There is little emphasis placed ont he oceanographic data collected through these permits. 10a-16

Patrick Cotter
Page -4-

17. There are a number of references in the DEIS to the beneficial effects of the wastes on productivity at the ocean dump site. The WQS endeavor to protect and maintain water quality in this area. In the WQS, it is stated that "All oceanic waters are presently close to their natural state. It is the intent of these standards to sustain this high quality." While support and propagation of marine life is designated as a protected use of oceanic waters, the enhancement of these waters should not used as a justification for ocean dumping of sludge. 10a-17

18. On page IV-14, it states that no areas of special biological significance have been designated. Pala Lagoon has been set aside under as a special area by the American Samoa Coastal Management Program. 10a-18

If you have any questions in the above comments, please contact me or Sheila Wiegman of my staff at (684) 633-2304.

Sincerely,

Pati Faiai, Director
American Samoa Environmental
Protection Agency

Attachments:

cc: Susan Cox, USEPA
Chairman, EQC
Environmental Coordinator

RESPONSES TO THE ENVIRONMENTAL PROTECTION AGENCY OFFICE OF THE GOVERNOR, AMERICAN SAMOA GOVERNMENT

Comment 10a-1:

The preferred site selected by EPA in the FEIS is outside the 3 mile limits of ASG territorial waters. In the opinion of the EPA Office of General Counsel, a consistency certification from ASG is not required for designation of the site. Since the site is outside state territorial limits, a Clean Water Act Section 401 water quality certification is not necessary. Act prohibits any State of Federal Territory from adopting or enforcing any rule or regulation related to ocean dumping.

Comment 10a-2:

The coagulant anionic polymer is an inert substance that, like the sludge, will be diluted by 1:250,000 within the dumpsite. The quantities added, which are reported to ASG monthly, would be rapidly dispersed.

Comment 10a-3:

The *Azuma Maru* was the vessel in use at the time the model was run. The difference in beam width between that vessel and the *Mataora* is 1.4 m. This would result in a change of less than 1.0 percent in the release zone (See added information in Section III.A.2.c.2). This is not a significant change.

Comment 10a-4:

With the selection of the deeper water site as the preferred alternative, the FEIS has been revised to reflect that choice throughout.

Comment 10a-5:

The statement is based on the quantitative research cited. However, Pago Pago Harbor is not the focus of the EIS. Scientists differ in opinions on this matter. Determining the former state of the harbor is conjectural dependent on the time period selected. Urban growth and development (land fill) preclude returning it to a pristine state which may have existed in the 1800s before coal and oil were introduced, and well before canneries operated.

Comment 10a-6:

Storm water runoff in culverts and streams carries urban trash and natural refuse into the harbor. The statement has been modified to avoid the impression that trash in the harbor is due to actions of Samoans or to lack of action by ASG.

Comment 10a-7:

The NPDES permit system does not apply to ocean dumping (See FEIS Section I.E.2.b). Ocean dumping permits can only be issued by MPRSA (See FEIS Section I.E.2.a). The text has been expanded to explain that the ASG EQC has not implemented a permit system of its own. However, EPA consults with ASG on issuing local permits as it has prior to issuing the cannery ocean dumping permits in effect from 1980 to 1989.

Comment 10a-8:

Quantities of waste in excess of those currently being dumped have been included in past permits and will be in the new permit. If significant increases are made following resolution of the NPDES evidentiary hearing, new modeling may be made a condition of the permit, based on the judgment of EPA.

Comment 10a-9:

No documentation of dates, times and locations have been received by EPA, and no samples collected for laboratory analysis to verify the nature of the waste reported. However, the preferred site selected is 5.45 n mi from shore, which will provide much greater protection from potential contamination.

Comment 10a-10:

The statement has been changed from "EIS" to "document".

Comment 10a-11

See comment 10a-9.

Comment 10a-12:

The statement and Table III.5.a. have been altered to indicate that ASG standards are the same as the federal standards. The "Air Emission Inventory for American Samoa" is on file with EPA Region 9 but emissions on the island are not considered by EPA to be germane to possible emissions at the dumpsite.

Comment 10a-13:

The statement has been deleted from the document.

Comment 10a-14:

See Sections III.A.2.c.1., and A.2.c.2, and Appendix B for calculations. Monitoring data referenced in Soule and Oguri (1983, 1984) and included in Appendices A1 and A2 provide observations on dilution and/or dispersion.

Comment 10a-15:

Monthly monitoring reports filed with EPA and sent to ASG indicate that nitrogen and phosphorus levels may occasionally exceed federal and ASG standards. With the selection of the deeper water site as the preferred site, ASG water quality will not be affected.

Comment 10a-16:

The nature of the sludge was described in the DEIS in pages III-3 to III-17. Tables III-1a and b give data on analysis for standard parameters for each cannery from 1980 through 1987, updated through 1988 in the FEIS. Table III.2 gives metals data for 1987 and 1988 and Table III-3 gives the quantities dumped monthly from 1980 through 1988. Oceanographic information gathered during the research permits is presented in pages III.55 to III.61 and illustrated in Figures III.15 to III.19 in the text. Appendices A1 and A2 are summaries of results for permits OD 86-01 and OD 87-01; the summaries for OD 88-01 and 88-02 are not available for inclusion at this printing.

Comment 10a-17:

There was no intent to justify ocean dumping on the basis of enhancement. Ocean dumping off American Samoa is the only environmentally viable alternative, as discussed in Chapter II. The hazards of terrestrial dumping discussed were experienced by American Samoa before ocean dumping was proposed (See also comment 3-2 from National Marine Fisheries Service). Tropical oceanic waters are nutrient poor and preserving them in their natural state may in fact reduce support and propagation of marine life. Selection of the deeper water site as the preferred alternative should help to sustain the natural state of ASG territorial waters.

Comment 10a-18:

Pala Lagoon has been added to the text.

DEPARTMENT OF MARINE AND WILDLIFE RESOURCES
AMERICAN SAMOA GOVERNMENT
PO 3730 Pago Pago, American Samoa 96799
(684) 633-4456/5102
October 12, 1988

To: American Samoa Environmental Protection Agency

From: David Itano, Chief Fishery Biologist, DMWR

Subject: Review and Comments on the Draft EIS for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes.

I was a resident of Coconut Point from 1984 to 1988 which is located about three nautical miles northwest of the center of the present cannery ocean disposal site. On a number of occasions my wife and I could distinctly smell the foul odor from the discharged material from the front yard of our house located near the southern end of Coconut Point. The odor was strong enough to indicate that the discharge plume was immediately offshore or had entered the reef areas adjacent to the airport runway. 10b-1

On three occasions while scuba diving on the edge of the Airport fringing reef, I observed a distinct layer of cloudy, dark colored water overlaying deeper clear waters. This layer of murky water extended from the surface to 10 to 15 meters in depth and contained very fine suspended solids. On several occasions, I have observed a similar layer of cloudy water while scuba or snorkel diving on the DMWR Fish Aggregation Buoy "B" that is located 3.5 nautical miles southeast of Pago Harbor. This buoy is located 2.5 nautical miles (nmi) northeast of the center of the present dumpsite. 10b-2

Last June, the layer of cloudy water was again observed while diving at the FAD. Visibility within the dirty layer of water was about one meter and it extended from the surface down to 5 meters in depth. After exiting the water, the rotten smell of the waste sludge was very noticeable on the gear, clothing and bodies of the divers who had entered the water confirming my belief that the layer of cloudy water was caused by the drifting sludge plume reaching the area. 10b-2 (cont.)

The edge of the airport reef is only 2.25 nmi north-northwest from the center of the present dumpsite and EPA monitoring cruises have shown that the sludge plume often travels northward or in an inshore direction. It stands to reason that if the sludge plume can travel 2.5 miles and still have a noticeable odor and color it can come inshore 2.25 nmi and impact the fringing reefs off Coconut Point and the Airport. I am convinced that some of the cannery wastes do reach the coral reefs and inshore areas of Tutuila and are capable of easily reaching Taema Bank. 10b-2 (cont.)

10b (cont.)

I am ndt convinced that the sludge plume would be beneficial to coral reefs as indicated in Table S.1. on page S-13 (Summary of Impacts... for the Present Site). Hermatypic corals need sunlight to live and anything that limits light penetration in seawater has a negative impact on coral. This Table S.1. also indicates that plankton, pelagic fish, pelagic invertebrates and coastal birds would somehow benefit from the dumping of waste sludge at the Present Site. However, an examination of Table S.2. (Summary of Impacts...for the Deeper Water Alternative) shows that sludge discharge in the Deeper Water Site would have no significant impact on the same criteria. 10b-3

I find this very curious as the plankton, pelagic fish, pelagic invertebrate and bird communities of the Present and Deeper Water Sites are virtually identical to each other. At the same time, Table S.1. states that commercial fishing stocks, sport fishing, subsistence fishing and other recreational activities would benefit from dumping at the Present Site. However, none of these benefits appear in Table S.2. for the Deeper Water Site. 10b-4

I seriously doubt if any fisheries are significantly improved by the dumping of sludge in our offshore waters, but I wonder why these claimed benefits are not granted to the Deeper Water Site that is only 2 nmi farther offshore? Also, from personal experience, I know that fishing vessels avoid the area of the discharge plume simply because it stinks and they choose not to fish near the area. 10b-4 (cont.)

Section S.b.3. on page S-9 outlines several drawbacks to the Deeper Water Site including; difficult navigation, increased cost and time, and monitoring difficulty. None of these drawbacks to this site are valid in regard to environmental impact issues. I have a US Coast Guard license in navigation and am familiar with coastal navigation. The Deeper Water Site would not be significantly more difficult to position than the Present Site and a good quality Radar would be able to give accurate range information to assure that the discharge was far enough offshore. Whether the discharge point is a bit to the east or west doesn't really matter as long as it is far enough offshore. 10b-5

The increased cost and time involved in discharging at the Deeper Water Site should not be listed as a drawback to this option. The canneries should bear the cost of adequate navigation equipment (better Radar) and discharging sludge at adequate distances from shore if they choose to process fish in American Samoa. The criteria for selecting an adequate distance should be made on the basis of environmental issues, not what is economically advantageous or convenient to the Canneries. 10b-5 (cont.)

Also, the limitations the Deeper Water Site may impose on monitoring programs is irrelevant. Sludge should be discharged

10b (cont.)

in the Harbor if easy monitoring is a priority, and the correct positioning of the disposal site should preclude the need for extensive future monitoring programs. If monitoring programs are necessary, the cost and logistics of completing them properly should be the responsibility of the canneries and be conducted wherever the selected site is located. It is true that exact positioning of monitoring substations would be difficult or impossible for the Deeper Water Site, but this is equally true of the Present Site and the even the Shallower Water Site. This condition is more a deficiency of the monitoring methodology and should not be listed as a disadvantage of the Deeper Water Site only. 10b-5 (cont.)

The Draft EIS states several times that the Deeper Water Site would have rougher seas, and higher swells than the Present Site. I have spent a great deal of time on these waters and I do not think that the sea conditions between these two sites only two nautical miles apart would be significantly different during most of the year.

It seems that the Draft EIS is written in a manner that strongly favors maintaining the dumpsite at the Present Site while highlighting the possible disadvantages of the Deeper Water Site. I hope these deficiencies are corrected in the Final EIS and a selection of the sludge dumpsite is made that reflects the environmental issues at hand. 10b-6

In summary, I believe that the cannery sludge waste does encroach on inshore coral reefs and that the sludge is not beneficial to coral reefs, marine fisheries or marine resources. If this were true, we should import the material from Puerto Rico and the Orient to enhance local marine resources and marine habitats. It is true that the sludge can act as a fertilizer to increase primary production and enhance the amount of harbor biota. However, this is not necessarily a benefit to tropical marine systems and should not be viewed and a positive aspect of sludge production and discharging. Fish kills periodically occur in Pago Harbor that are probably a result of: poor mixing and exchange rates and nutrient overloading. I would support the designation of the Deeper Water Site for future fish processing waste discharge. This would help to assure that the sludge did not impact coral reefs or bother residents under present and possibly larger future discharge loads. 10b-6 (cont.)

Specific Comments on Draft EIS

Page Pgh Comment

S-5 3 See attached text documenting sludge plume reaching airport fringing reef. 10b-7

S-6 1 Fecal material can enhance the growth of some molluscan species also. 10b-8

S-9 2 The Radar, sextant and sighting compass in question were not sufficiently accurate to position all the monitoring substations at the present site either. A better Radar should be installed on the discharge vessel equipped with a relative bearing circle and a variable range marker with accurate, digital readout. 10b-9

The increase in time and expense of the Deeper Water alternative should be viewed as a necessary consequence of the program if it is deemed necessary instead of a drawback to this alternative. 10b-9 (cont.)

S-13 to S-16 Explained in attached text.

I-5 2 The canneries apparently continue to draw large sharks to the area as this area is one of the only placed in American Samoa where large tiger and hammerhead sharks are known to frequent. 10b-10

I-5 3 Whale Rock and Toasa Rock are excellent places to dive if visibilities are good. However, algal blooms fed by the excess nutrients in the bay reduce visibility to near zero ruining diving and has lead to the death of many former coral rich areas. The last sentence implies that the removal of wastes from the harbor would be detrimental to the harbor ecosystems. This may be true in temperate marine systems but this theory should not be transposed to this situation. 10b-11

I-8 3 Ms. Coven was not yet in Samoa in 1980. 10b-12

II-13 2 See attached text on sludge reaching shore and odor from plume.

II-16 4 The American Samoa Coral Reef Inventory (AECOS 1980) and subsequent DMWR coral reef surveys have identified an extremely rich coral community on the reef adjacent to the Airport runway. 10b-13

II-21 1 See attached text on roughness of seas and monitoring program.

III-24 2 The text of this paragraph make it seem that the Deeper Water Site is 20 miles farther out, not two miles. I think it would be entirely feasible to take water samples at this site and 10b-14 the vessel that was conducting the monitoring program last year regularly fishes 10 to 20 miles offshore from Tutuila Island. 10b-14

III-85 1 Tropical waters do not need to be nutrient rich or support high primary productivity because symbiotic algae are contained in the coral polyps that create highly diverse coral reefs. 10b-15

III-90 2 Plankton investigations have been underway for the last year by the DMWR. 10b-16

III-94 2 Scientific names for marlin and sailfish are reversed. 10b-17

III-95 2 Humpback whales are <u>frequently</u> sighted off southern Tutuila during the peak season (Aug-Nov) but not seen the rest of the year. 10b-18

III-97 2 Pelagic white tipped sharks were observed entering the discharge plume during monitoring cruises apparently attracted to the wastes. No small baitfish or other fish were observed in the area that may have attracted the sharks. 10b-19

III-111 3 The text refers to the present dumpsite as the "preferred" site even though this draft EIS is not supposed to make choices at this time. 10b-20

III-112 1 At present there are no fishermen or resource specialists in the Territory that favor the idea of placing a FAD in the center of the sludge dumpsite. Fishing vessels avoid the area of the sludge plume due to the foul odor and there is some indication that pelagic fish avoid the plume (page III-94 of this report). Most fishermen believe that the plume ruins fishing in the area reducing the ability of game species to see their lures. 10b-21

IV-11 2 Turbidity does at times reach the coral reef areas. 10b-22

IV-19 See Text for details. I do not think that the difference in the pelagic fish, pelagic inverts or coastal bird populations are significantly different between the two sites. 10b-23

RESPONSES TO COMMENTS BY THE DEPARTMENT OF MARINE AND WILDLIFE RESOURCES, AMERICAN SAMOA GOVERNMENT

Comment 10b-1

It is not possible to correlate odors with events from anecdotal statements. It would be helpful to enforcement if the date, time and location of such episodes were reported to EPA, along with observations on wind, weather and current conditions.

Comment 10b-2:

The deeper water site selected by EPA as the preferred alternative is 5.45 n mi from shores, which will protect them from possible incursions.

Comment 10b-3:

Tables have been removed from the Summary so that discussion of each factor can be presented (See Chapter IV) and avoid oversimplification. The greater distance from shore of the deeper water site may prevent nutrients from reaching shallower water and the longshore current where concentrations of plankton and forage fish may occur. However, the NMFS letter (comment 3-7) indicates the expectation that the sites would show similar results. See also letter 6 from the University of Hawaii, comment 6-2.

Comment 10b-4:

See comment 10b-3.

Comment 10b-5:

The deeper water site was selected as the preferred site to protect reefs and territorial water quality. The advantages and disadvantages of the site were presented in Chapter II and Chapter IV. The selection considered ecological concerns paramount, recognizing that it will involve certain difficulties such as longer turn around time, which is a socioeconomic concern. The canners are willing to accept those conditions.

There was no intent to favor the present dumpsite over the deeper water site, but to present all relevant information on each site. The present site appears to be adequate for existing quantities of waste under disposal condition in the permit. EPA has not received any written complaints about encroachment on reefs or shores with the DEIS comments were submitted. See comment 10b-1.

Comment 10b-6:

The deeper water site has been selected on the basis of ecological concerns.

Comment 10b-7:

Attachment noted

Comment 10b-8:

Comment noted.

Comment 10b-9:

Radar is required in the permit. The monitoring program is being redesigned to eliminate the substations which were difficult to position accurately. See also comment 10b-5.

Comment 10b-10:

We have no documentation of sharks drawn to the canneries but must rely on anecdotal reports. Sharks may follow schools of forage fish into the harbor, which is the only large, deep water embayment on Tutuila. Sharks are also attracted to the Fish Aggregation Device (FAD) buoy, where small fish congregate, but are rarely seen.

Comment 10b-11:

Comment noted. The low nutrient tropical environment is discussed in section III.C.

Comment 10b-12:

The typographical error is corrected to read 1986.

Comment 10b-13:

Text is changed to reflect richness.

Comment 10b-14:

Comment noted.

Comment 10b-15:

The ocean dumpsites do not contain reef building corals.

Comment 10b-16:

There is no mention of plankton surveys on p III-90, 2; p III-88 is revised to specify <u>published</u> plankton studies.

Comment 10b.17:

The text has been corrected.

Comment 10b-18:

Comment noted. Information on whales sighted was supplied by NMFS. Humpback whales have not been reported during monthly monitoring, although pilot whales were seen in December 1987.

Comment 10b-19:

One white tipped shark was reported as being sighted during monitoring in April 1988 and one unidentified shark was reported in September 1987 and June 1988.

Comment 10b-20:

The text has been revised to reflect the selection of the deeper water site as the preferred site.

Comment 10b-21:

See comment letter 7 from Henry Sesepasara, Manager of the American Samoa Coastal Management Program and formerly, Manager of the Office of Marine and Wildlife Resources. Non-quantitative statements of "most fishermen believe" cannot be evaluated. The plume is so small in relation to the area available for pelagic fish or sports fishermen as to be inconsequential. Nutrients dissipated from the plume may still benefit adjacent sea areas.

Comment 10b-22:

Comment noted.

Comment 10b-23:

Comment noted.

10c

Le Vaomatua
P.O. Box B
Pago Pago, American Samoa 96799

October 26, 1988

Mr. Pati Faiai
Environmental Protection Agency
Governors Office
Pago Pago, AS 96799

Dear Mr. Faiai,

In response to the EIS on the ocean dumping of cannery sludge we would like to request a public hearing so that the public has an opportunity to verbally comment on the report as well as some of the following: 10c-1

a) continued reports from fishermen that the dumping is taking place earlier than the specified site. 10c-2

b) reported cases where the sludge being dumped ARE observed along the beaches and shores from Nu'uuli to Leone. 10c-3

c) concern that the waster water being dumped in Pago Pago Harbor is not clean enough and additional cleaning needs to be carried out which would increase the amount of sludge to be disposed. 10c-4

d) the quality of the water in Pago Pago Harbor and along the southern shores of the island can be improved with a minumum of additional environmental concern on the part of the canneries. Again, as suggested before these might include improved methods of cleaning the waste water and disposing of the sludge an additional few miles out to sea to assure no return to the island. 10c-4 (cont.)

We do not think these issues have been addressed fully and on an island where verbal tradition far exceeds written tradition we feel a public hearing would allow those that are concerned a better chance to be heard than they would otherwise.

Sincerely,

Caroline Sinavaiana

Caroline Sinavaiana
President

RESPONSES TO COMMENTS BY LE VAOMATUA

Comment 10c-1:

No public hearing has been scheduled by EPA because selection by EPA of the deeper water site as the preferred alternative has been made with input from public agencies, scientists, canners and the public on the basis of ecological concerns.

Comment 10c-2:

No documentation has been received by EPA of short dumping. See comment 7-2.

Comment 10c-3:

See comment 10c-2. The selected preferred site is 5.45 n mi from beaches and should provide added protection.

Comment 10c-4:

The quality of harbor waters is under the NPDES permit system. See also comment 10c-3.

11.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307

OCT 31 1988

Patrick Cotter
Ocean Dumping Coordinator
U.S. EPA REgion 9 (W-7-1)
215 Fremont Street
San Francisco, CA 94105

Re: Draft Environmental Impact Statement for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes

Dear Mr. Cotter:

We have reviewed the subject document and offer the following comments for your consideration. The Service's remarks are prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and other authorities mandating Department of Interior concern for environmental values. They are also consistent with the National Environmental Policy Act.

General Comments

The Service believes that the subject document lacks essential
information needed to evaluate the effects of fish waste dumping
on nearshore reef ecosystems on Tutuila Island, American Samoa.
Specifically, the document omits any mention of the waste plume
contacting the southern shoreline of Tutuila in recent months. 11-1
Furthermore, we are concerned that the document appears to offer
strong support for the existing ("preferred") ocean dump site,
while giving insufficient consideration to alternative dump sites
farther from shore. 11-2

Marine biologists of NOAA-Fisheries and the American Samoa
Government have informed us that they observed the plume of fish
processing wastes contacting the reef at Tafuna, near Tutuila's
airport, in recent months. Both of these agencies and the Fish
and Wildlife Service are concerned that fish wastes can have a
serious detrimental impact to fringing reefs over the long-term.
That the present dump site is not suitable under certain
oceanographic and atmospheric conditions is of particular concern
in light of the fact that the two canneries in Pago Pago Harbor
propose to increase the volume of waste dumping in the near
future. 11-3

Summary Comments

We ask that strong consideration be given to the recommendations presented by NOAA-Fisheries. The environmental impact statement should acknowledge that the waste plume has been observed drifting onto the southern shore of Tutuila Island, and should present a thorough evaluation of its long-term effects upon nearshore reef ecology. In light of this development, the Service does not believe that the existing dump site should be endorsed at the present time. We ask that the benefits of a dump site located father offshore be accurately re-evaluated, and that the results of this re-evaluation be presented in a revised draft document. 11-4

We appreciate this opportunity to comments.

Sincerely yours,

Ernest Kosaka
Field Office Supervisor
Environmental Services

cc: NMFS-WPPO
Office of Marine Resources, ASG
Office of Development Planning, ASG

RESPONSES TO COMMENTS FROM THE FISH AND WILDLIFE SERVICE PACIFIC ISLANDS OFFICE, U.S. DEPARTMENT OF THE INTERIOR

Comment 11-1:

Monthly monitoring (Appendix A1, A2; other reports on file with ASG, FWS and EPA) shows the plume to be near or below permitted limits at the perimeter of the dumpsite. No reports have been received by EPA of fish waste reaching shore until the DEIS letters of comment were received.

Comment 11-2:

The DEIS presented advantages and disadvantages of several alternatives. The selection of the deeper water site by EPA is based on input from public agencies, scientists, canners and the public.

Comment 11-3:

No documentation of date, time, place or sample taken has been received by EPA. Such instances should be documented. Selection of the deeper water site should alleviate effects if they are occurring.

CHAPTER VI. LIST OF PREPARERS

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Mr. Patrick J. Cotter, Regional Ocean Dumping Coordinator and EIS Review,	U.S. Environmental Protection Agency
Mr. Jeffrey Naumann, EIS Review,	Star-Kist Foods, Inc., for Star-Kist, Samoa.
Mr. Fred H. Avers, EIS Review,	Van Camp Seafood Co., Inc., for Samoa Packing.

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APPENDIX A.1.

Summary Report on

OCEAN DUMPSITE MONITORING, AMERICAN SAMOA

29 APRIL 1987 - 25 AUGUST 1987

EPA Permit No. OD 86-01

1. INTRODUCTION

A series of monthly field monitoring cruises were carried out in conjunction with ocean dumping of cannery wastes in partial fulfillment of the requirements of ocean dumping research permit OD 86-01 issued to Star-Kist Samoa, Inc., and Samoa Packing Co. Cruises were conducted during the period from April 29 to August 25, 1987. This report summarizes the findings obtained during these cruises, each of which has been reported on separately (SOS-Environmental, Inc., 1987a-e).

The dumpsite is a circle 1.5 n mi in diameter centered at 14°22.18' S latitude and 170°40.87' W longitude in waters of about 900 fathoms depth. The nearest point of land to the dumpsite is Matautuotafuna Point, which lies just seaward of the middle of the airport runway, and lying about 2.25 n mi northwest of the dumpsite. The dumpsite is about 4.7 n mi due south of the entry to Pago Pago Harbor, making navigation for the dump vessel relatively simple.

During these cruises the dump vessel the MV *Azuma Maru*, discharged a full load of 24,000 gallons consisting of approximately equal parts of waste from Star-Kist Samoa and Samoa Packing Co. facilities. The dump vessel was required to steam in a circle of 0.2 n mi diameter within the dumpsite, discharging at a rate not to exceed 140 gallons per minute per knot of speed.

All observations and sampling for this monitoring were conducted by personnel of the American Samoa Government's Office of Marine and Wildlife Resources using their research vessel, the RV *Sausauimoana*.

2. METHODS

Prior to the start of dumping on a scheduled monitoring cruise, the sampling vessel measured the current direction and velocity with an Inter-Ocean Model S-4 meter at the center of the dumpsite, which was designated

Station 2B, and measured temperature, salinity, dissolved oxygen, pH and beam transmittance at four depths, 1 m, 3 m, 10 m and 20 m. Observations of wind, wave height, Secchi disc extinction depth and water color based on the Forel-Ule scale were also made. Based on the current meter information the sampling vessel then moved to a point 1.5 n mi upcurrent, designated Station 1, and repeated the sampling protocol. In addition, water samples were taken from the same depths for laboratory analysis of total nitrogen, total phosphorus, total suspended solids and total volatile solids. It was only at these two stations that the current meter was used.

Station 2A was located in the wake of the discharging dump vessel, near the vicinity of Station 2B, and the same sampling protocol was used at stations occupied prior to the start of dumping. The current meter was not used, but a set of drogues with the vanes set at 3 m depth, were deployed.

Similar sets of samples and observations were taken during each monthly monitoring cruise at Station 3, located 0.75 n mi downcurrent from Station 2A, and at Station 4, 1.0 n mi downcurrent from Station 2A. On alternate monitoring cruises, Stations 5, 6 and 7 were also occupied. Station 5 is 0.75 n mi downcurrent from Station 2A and 90° to the current direction, Station 6 is 0.75 n mi upcurrent from Station 2A, Station 7 is 0.75 n mi downcurrent from Station 2A and 270° to the current direction.

The drogues were tracked for four hours following their release and their position recorded hourly; at each position a vertical profile to 20 m was taken with the transmissometer. All visible biota were identified as closely as possible, enumerated and notes of activities recorded at each of the drogue stations.

The equipment used for field measurements and sample collections consisted of a Martek Mark VII Water Quality Analyzer to measure temperature, salinity, dissolved oxygen and pH, a Martek transmissometer to measure light beam transmittance, and a Naumann self-closing sampler to obtain the needed water samples. An InterOcean S4 current meter was modified to accommodate a deck readout.

All water samples were refrigerated and stored in darkened containers until return to the shore. They were then transported to the Star-Kist Samoa laboratory for more appropriate storage until they were analyzed or, for the total-N, TSS and TVS samples, shipped to Honolulu for analysis by Aecos Laboratories. Total-P and BOD were determined at the Star-Kist Samoa laboratory.

Determination of the position of all stations was done by sighting of known landmarks ashore through a hand-held sighting compass or by determination of angles between known shore landmarks using a sextant. This proved adequate since the sampling vessel did not have a radar unit capable of more precise positioning. Loran is not available in American Samoa and satellite navigation is usable only during the passage of the navigational satellite.

3. RESULTS AND DISCUSSION

Detailed reports of the data accumulated during this series of monitoring cruises have been reported (SOS Environmental, Inc., 1987a-e) and will not be repeated except as necessary to summarize and indicate possible trends.

3.a. Currents and Waste Field Drift

The current speed and direction, as indicated by both the current meter and the drogues, are shown in Figure A.1.1.a.,b., and data are summarized in Table A.1.1. Included in this table for comparison are data

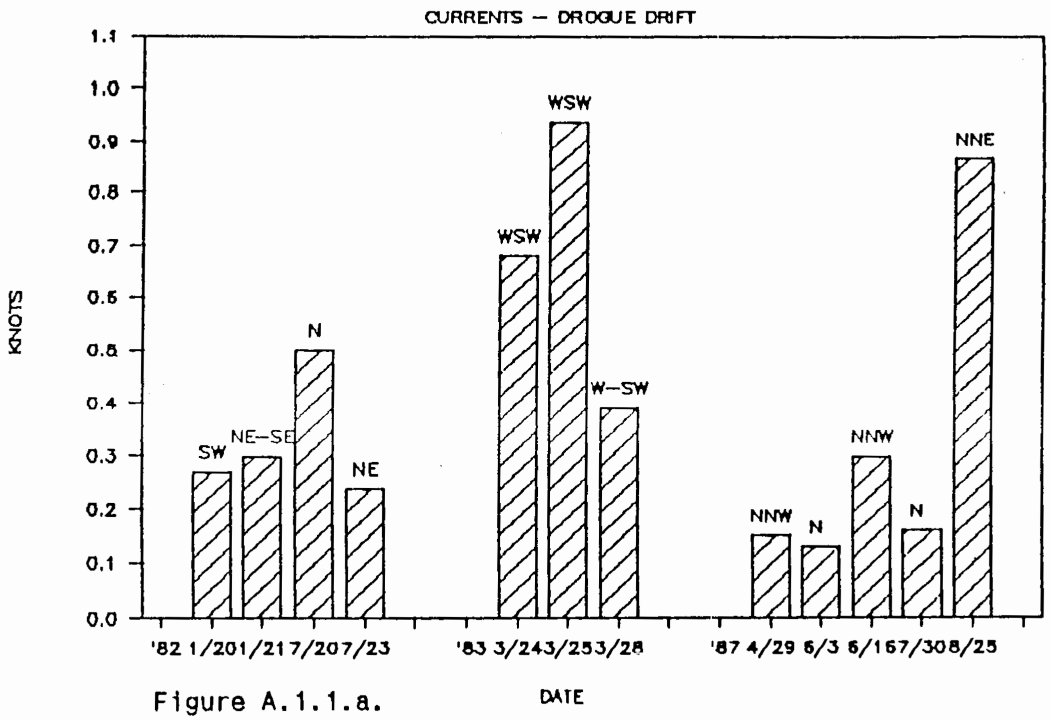

Figure A.1.1.a.

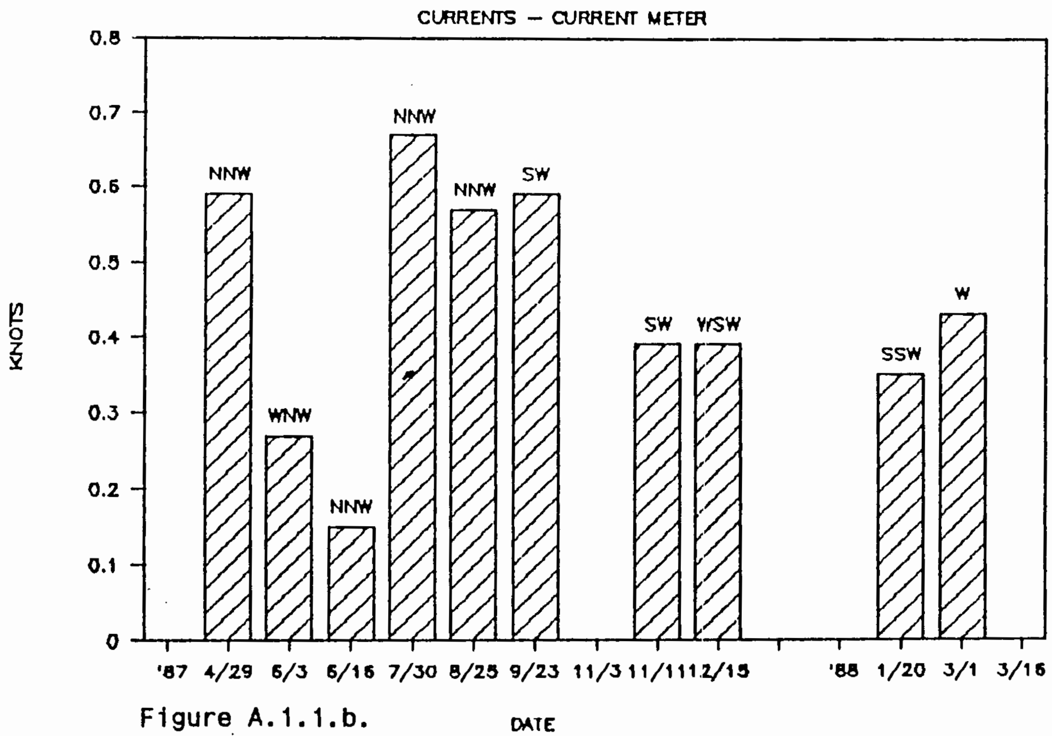

Figure A.1.1.b.

a. Direction and speed of currents determined by drogues in 1982, 1983 and 1987.

b. Direction and speed of currents determined by current meter in 1987-88.

Note seasonal shift in direction to the west-southwest in most of September-March (summer) data and to a northerly directions between April-August (winter).

Table A.1.1. Currents Near the Dumpsite, January 1982 - March 1988. Currents observed near the dumpsite January and July of 1982, March of 1983 and during monitoring cruises, April 1987 - March 1988 are included. Winds are included, if available. Current meter readings are averaged for depths from 3 to 20 m. Current and wind speeds are in knots. Drogue drift data for 1982 and 1983 are based on observations of surface drogues. In 1987 drogues are deployed at 3 m. Current directions are the direction to which the current is flowing and wind direction is the direction from which the wind is blowing.

	Drogue			Current meter		Wind	
Date	Velocity	Direction		Velocity	Direction	Velocity	Direction
1982							
1/20	0.27	SW				3-14	NE
1/21	0.30	NE-SE				12-16	NE
7/20	0.50	N	*			10-16	S
7/23	0.24	NE				6-10	S
1983							
3/24	0.68	WSW	**			6-10	SE
3/25	0.94	WSW	*				
3/28	0.39	W-SW					
1987							
4/29	0.15	NNW	*	0.59	NNW	12	ESE
6/ 3	0.13	N		0.27	WNW	4	ESE
6/16	0.30	NNW	*	0.15	NNW	4.5	ESE
7/30	0.16	N	*	0.67	NNW	11	SE
8/25	0.87	NNE	*	0.57	NNW	11	SE
9/23				0.59	SW	11	SE
11/ 3				0.43	N		
11/11				0.39	SW	10-13	SE
12/15				0.39	WSW	2	NE
1988							
1/20				0.35	SSW	8	E
3/ 1				0.43	W	10	SW

* Field notes indicate that the drogues outsailed the waste field.

** No drogues were used. The waste field, itself, was tracked.

from drogue studies conducted in 1982 and 1983 in the vicinity of the present dumpsite (See Section III.B.2.c.) by Soule and Oguri (1983a, 1984). Only the data for the surface drogues used in those studies, which also included drogues with vanes set at 10 and 20 m, are presented here because that depth is most comparable to the 3 m drogues specified for this study.

Both current meter and drogue drift data from the April-August 1987 monitoring studies indicated a flow northward for each of the cruises, with drogue drift direction showing a tendency to drift to the right of the direction indicated by the current meter. The drogue studies conducted in July of 1982 also showed a northerly drift, as did the one conducted on January 21, 1982, during which the waste field was seen to split, carrying some drogues to the northeast and others to the southeast in a freshening northeast wind. The drogues released at the dumpsite on January 20, 1982 and all three drogue studies conducted in March of 1983 showed currents moving to the southwest, essentially paralleling the shore and the longshore draft. The northerly movement of most drogues was not sufficient to reach the longshore current.

Results suggest that there is a seasonal shift in prevailing offshore currents in the area, with a southern hemisphere summer trend to the southwest, as shown by the January 1982 and March 1983 data, and the winter currents trending northerly, as shown by July 1982 and the April though August 1987 data. It should be noted, that the El Niño Southern Oscillation (ENSO) event in 1982 and 1983, exerted profound effects on both atmospheric and oceanic conditions extending throughout much of the Pacific Basin. The extent to which this could have altered local circulation patterns is not known. There was a short ENSO event in 1987.

Current meter velocities, exceeded those shown by drogue drift during 3 of the monitoring surveys by a factor of 2 to 4; current meter velocity was one-third to one-half the drogue speed during the other monitoring cruises. The current meter velocities reported herein are averaged over the depths from 3 to 20 m. In all cases the standard deviation of the data suggest that the average speed measured by current meter is significantly different from the drogue speed. It is unlikely that wind effects on the drogues could account for the difference, since drogue velocity on June 3 and July 30 were similar, although the winds differed by a factor of 3.

The current meter tended to indicate a greater current speed than the 3 m drogues used in the 1987 monitoring studies. These drogues, in turn, tended to move faster than the waste field, based on field notes of the observers. A similar occurrence was noted for the surface drogues in 2 of the 6 drogue release studies reported by Soule and Oguri (1983a, 1984). The surface drogues in all of the earlier studies also outsailed the 10 and 20 m drogues deployed during the 1982 and 1983 studies. The 10 and 20 m drogues had a lesser tendency to drift out of the field and seem preferable to surface or 3 m drogues.

3.b. Water Quality Parameters

The station pattern mandated in the permit, based on the direction established by the current meter reading at Station 2B, before the dump, resulted in almost all water quality stations, being outside the waste field except for Station 2A, sampled immediately after dumping. The data, therefore, more adequately represent oceanic background conditions rather than the dispersing and diluting waste field.

Neither temperature nor salinity were expected to vary significantly as a result of the ocean dumping, and indeed, they remained essentially constant for each cruise, showing no evidence of a thermocline or other vertical discontinuity over the depths and locations measured.

Table A.1.2. presents the data from Station 2A at the depth at which the maximum effect of the waste was shown, and compares the data to the range of values found at all other stations and depths, including the stations occupied prior to the release of wastes. The data are divided into three groups in this table. The first group, at the top of the table, represents the data measured in situ, including dissolved oxygen, pH and percent transmittance. The second group includes Secchi disc depth and Forel-Ule water color. These data are more subjective, requiring a judgment on the part of the observer, and can vary from observer to observer, and ambient environmental conditions such as sea state, weather and time of day. The last group includes data from laboratory analyses of water samples collected separately but in conjunction with the instrument data. The location of the vessel, and the location of the sampling devices along the side of vessel, vary as the vessel drifts during sampling, as does the sampling line angle; also, the vessel may be partially in the plume but be out of it by the time data to 20 m have been recorded. The data reported here include total suspended solids, total nitrogen, total phosphorus and BOD.

Among the parameters, measured only percent transmittance consistently reflects the presence of the waste. Ammonia-N has, in previous studies, correlated better with BOD_5 than transmittance has. Both dissolved oxygen and pH fall within the "background" range in at least half of the occurrences. Among the subjective data, the Secchi depth shows a drastic departure from background but water color is clearly different in only two of the occurrences. The chemical data do not show any consistent

Table A.1.2. Comparison of Station 2A Data with the Range of Values Found at All Other Stations and Depths. Station 2A data for DO and pH are based on the depth showing the lowest %T. Data for TSS, Total N, Total P and BOD data are from the 1 m depth.

	April 29	June 3	June 16	July 30	August 25
Sta 2A depth m	3	1	3	1	10
DO - mg/l					
Sta 2A	9.2	9.3	6.6	8.4	5.9
Others-Range	5.3 - 8.8	6.5 - 9.1	6.1 - 8.0	6.9 - 8.7	5.4 - 7.2
pH					
Sta 2A	7.96	7.99	8.22	8.23	-
Others-Range	8.20-8.24	7.99-8.20	8.16-8.24	8.03-8.27	-
% T					
Sta 2A	79.6	32.7	76.2	74.7	33.9
Others-Range	89.3-96.0	84.8-93.5	90.5-93.0	85.1-93.0	91.7-96.3
Secchi - meters					
Sta 2A	8	4	2	32	6
Others-Range	32 - 49	31 - 36	28 - 38	24 - 31	23 - 28
Color - FU					
Sta 2A	III	IV	IV	II	III
Others-Range	I - II	II - IV	II	II - III	II - III
TSS - mg/l					
Sta 2A - 1m	2.5	19.0	4.4	8.3	11.4
Others-Range	0.3-14.3	2.0 - 3.0	1.1-10.3	0.9-20.3	0.7-6.4
Total N - mgN/l					
Sta 2A - 1m	0.31	0.66	0.22	0.27	0.51
Others-Range	0.15-0.31	0.15-0.26	0.05-0.27	0.10-0.45	0.08-0.15
Total P - mgP/l					
Sta 2A - 1m	0.065	0.069	0.079	0.139	0.109
Others-Range	0.19-0.082	0.001-0.150	0.012-0.044	0.027-0.256	0.000-0.306
BOD					
Sta 2A - 1m	-	13.27	13.0	3.9	11.5
Others-Range	-	1.29-8.22	2.3-4.7	1.5-28.8	0.9-4.7

trend, which would suggest the inadequacy of some parameters as indicators of the waste field.

During the only cruise of this series when field notes indicated that the drogues stayed within the field, on June 3, the beam transmittance data collected in conjunction with the hourly determination of drogue position show a slight reduction from similar data obtained from the water quality stations, particularly Station 1 and 2B, occupied before the start of dumping.

The results and discussion suggest that optical measurements and observations, including the unaided human eye, appear to be the most adequate means among those used for determination of the presence of the waste field.

3.c. Marine Organism Sighted

During monitoring cruises there were sightings of birds, primarily terns and boobies, occurring either as schools or in smaller groupings. Schools of skipjack were also sighted on most cruises, and occasional other sightings of a single organism, such as porpoise or shark.

The area is relatively depauperate of visible fauna. This was also noted by Soule and Oguri (1983a, 1984) for their cruises in the area during 1982 and 1983.

3.d. Immediate Dilution

Immediate dilution was calculated by comparison of some of the water quality data from Station 2A, immediately after dumping, with similar data from analysis of the sludge for most of the cruises conducted under this ocean dumping permit. These data, taken as a ratio, are presented in Table A.1.3., together with a few similar data from 1982 and 1983 cruises.

The ratios, although varying widely, suggest that dilution of the waste rapidly reaches 3 to 4 orders of magnitude, averaging more than

Table A.1.3. Dilution of Wastes upon Discharge into the Ocean. Based on the change in selected components in the waste compared to the change in the same parameters measured in the wake of the discharging dump vessel.

	1982		1987			
Component	Jan 20	July 20	June 3	June 16	July 30	August 25
TSS			6,214	28,657	38,450	22,660
Total P			10,725	23,139	12,550	16,110
BOD	13,385	33,664	11,328	6,423	72,692	8,300
NH3		4,435				

1:20,000, upon discharge from the dump vessel.

CONCLUSIONS

1. Both current meter and 3 m drogue drift are adequate to predict the direction of drift of the waste field, but are not capable of establishing the speed of movement of the field.
2. Among the parameters routinely measured during this series of monitoring cruises, none were totally adequate for identifying and quantifying the waste field.
3. The immediate dilution of the waste upon discharge from the dump vessel is about 4 orders of magnitude and, the waste, apparently exerts an insignificant effect on water quality.
4. There is very little macrobiota to be affected by the waste discharged. The field appears neither to attract nor repel indigenous species.

RECOMMENDATIONS

1. A station pattern based on visual determinations of the extent and advance of the leading edge of the waste field, and water quality stations at timed intervals within the apparently most dense part of the field would yield more pertinent data on the fate of the wastes and their effective concentration.
2. Simplification of the monitoring requirements to eliminate parameters that are inadequate to define the presence and concentration of the waste, would ease the difficulties of carrying out a high technology program in a low tech milieu. Substitutions with parameters such as ammonia-N that can more easily be determined under existing conditions is advisable.

APPENDIX A.2.

Summary Report on

OCEAN DUMP SITE MONITORING, AMERICAN SAMOA

September 23 1987 - March 1 1988

EPA Permit NO. OD 87-01

1. INTRODUCTION

A series of field monitoring cruises in conjunction with ocean dumping of cannery wastes were performed at approximately monthly intervals in partial fulfillment of the requirements of ocean dumping research permit OD 87-01 issued to Star-Kist Samoa, Inc., and Samoa Packing Co. Cruises were conducted during the period from September 23 1987 to March 1 1988. This report summarizes the findings obtained during these cruises, each of which has been reported on separately to EPA Region 9.

The dumpsite is a circle 1.5 nautical miles (n mi) in diameter, centered at 14°22.18' S latitude and 170°40.87' W longitude in waters of about 900 fathoms depth. The nearest land to the dumpsite is Matautuotafuna Point, just seaward of the middle of the airport runway, and lying about 2.75 n mi northwest of the dumpsite. The dumpsite is about 5 n mi due south of the entry to Pago Pago Harbor, making navigation for the dump vessel relatively simple.

The dump vessel, the MV *Azuma Maru*, during these cruises would discharge a full load of 24,000 gallons consisting of approximately equal parts of waste from Star-Kist Samoa and Samoa Packing Co. facilities. The dump vessel was required to move in a circle of 0.2 n mi diameter within the dumpsite, discharging at a rate not to exceed 140 gallons per minute (gpm) per knot of speed.

The sampling vessel from which all observations were made and all samples were collected was the MV *Dream Girl*. The cruise leaders during these monitoring cruises were Sione Puloka of Samoa Packing for cruises of September 23 1987, Sam Latham for cruises on November 11 and December 15 1987, Larry D. Oney in January 20 1988, and David Itano, Chief Biologist for the American Samoa Government's Office of Marine and Wildlife Resources on March 1 1988.

2. METHODS

On a scheduled monitoring cruise, prior to the start of dumping, the sampling vessel established current direction and velocity at the center of the dumpsite, which was designated Station 2B, and measured temperature, salinity, dissolved oxygen, pH and beam transmittance at depths of 1, 3, 10 and 20 m. Based on current meter information, the sampling vessel then moved to a point 1.5 n mi upcurrent, designated Station 1, and repeated the sampling protocol. Station 7b, 1400 m downcurrent was then occupied and the same parameters were measured. Water samples were collected from the same depths at each of these stations for laboratory determination of total nitrogen, total phosphorus, total suspended solids and total volatile solids.

Station 2 was occupied in the wake of the discharging dump vessel near the vicinity of Station 2B following the same sampling protocol with the exception of current measurements, and sampling was limited to the upper 10 m of depth.

Stations 3 through 7 were located, respectively, 20 m, 50 m, 100 m, 200 m and 1400 m downcurrent from Station 2. At Stations 3 and 4, 2 substations were established on either side of the main station at right angles to the direction of flow. At Stations 5 and 6, 3 such substations were established on either side of the main station. Station 7 had 4 substations established on either side. At each of these stations transmittance profiles to 10 m were obtained with an additional reading at the 20 m depth for the center station.

Throughout the cruises observations were made and recorded of the visible marine associated biota.

The equipment used for the field measurements and sample collections consisted of a Martek Mark VII Water Quality Analyzer to measure temperature, salinity, dissolved oxygen and pH, a Martek transmissometer to measure beam transmittance, and a Naumann self-closing sampler to obtain the needed water samples. An Interocean S4 current meter was modified to accommodate a deck readout to measure currents,

All water samples were refrigerated and stored in darkened containers until return to the shore. They were then transported to the Star-Kist Samoa laboratory for more appropriate storage until they were analyzed or, for the total-N, TSS and TVS samples, shipped to Honolulu for analysis by Aecos Laboratories. Other analyses were carried out at the Star-Kist Samoa laboratory.

Determination of the position of all stations was done by sighting of known landmarks ashore through a hand-held sighting compass or by determination of angles between known shore landmarks using a sextant. This proved adequate since the sampling boat did not have a Radar unit capable of more precise positioning. Loran is not available in American Samoa and satellite navigation is usable only during the passage of the navigational satellite, which restricts such readings to the specific times when the satellite is in an appropriate position.

3. RESULTS AND DISCUSSION

Detailed reports of the data accumulated during this series of monitoring cruises have previously been reported to EPA Region 9. These data will not be repeated except as necessary to summarize and indicate possible trends.

3.a. Currents and Waste Field Drift

The current speed and direction, as indicated by current meter measurements for the present permit and for permit OD 86-01, and drogue studies conducted as part of the requirements for permit OD 86-01, are summarized in Table A.2.1. Also included in this table are data from drogue studies conducted in 1982 and 1983 in the vicinity of the present dumpsite by Soule and Oguri (1983, 1984). Only the data for the surface drogues used in those studies, which also included drogues with vanes set at 10 and 20 m, are presented here because that depth is most comparable to the 3 m drogues specified for the monitoring under ocean dumping permit OD 86-01.

Both current meter and drogue drift data from the 1987 monitoring studies indicated a flow northward for each of the cruises, with drogue drift direction showing a tendency to drift clockwise to the direction indicated by the current meter. The drogue studies conducted in July of 1982 also showed a northerly drift, as did the one conducted on January 21 1982, during which the waste field was seen to split, carrying some drogues to the northeast and others to the southeast in a freshening northeast wind. The drogues released at the dumpsite on January 20 1982 and all three drogue studies conducted in March of 1983 showed currents moving to the southwest, essentially paralleling the shore.

The monitoring conducted from September 23 1987 to March 1 1988 under ocean dumping permit OD 87-01 also included current measurements made by current meter but deleted the use of drogues. These data show current speeds similar to those of the earlier data, rarely exceeding 0.5 knot. The direction of flow was predominately toward the southwest, ranging from west to south southwest except for November 3 when it flowed north.

The direction of current flow near the proposed dumpsite for the various observations is summarized in Table A.2.2. A distinct seasonal pattern is evident. A northerly flow (north northwest to northeast) dominated from the end of April to the end of August during the winter

Table A.2.1. Currents Near the Dumpsite, January 1982 - March 1988. Currents observed near the dumpsite January and July of 1982, March of 1983 and during monitoring cruises, April 1987 - March 1988 are included. Winds are included, if available. Current meter readings are averaged for depths from 3 to 20 m. Current and wind speeds are in knots. Drogue drift data for 1982 and 1983 are based on observations of surface drogues. In 1987 drogues are deployed at 3 m. Current directions are the direction to which the current is flowing and wind direction is the direction from which the wind is blowing.

	Drogue			Current meter		Wind	
Date	Velocity	Direction		Velocity	Direction	Velocity	Direction
1982							
1/20	0.27	SW				3-14	NE
1/21	0.30	NE-SE				12-16	NE
7/20	0.50	N	*			10-16	S
7/23	0.24	NE				6-10	S
1983							
3/24	0.68	WSW	**			6-10	SE
3/25	0.94	WSW	*				
3/28	0.39	W-SW					
1987							
4/29	0.15	NNW	*	0.59	NNW	12	ESE
6/ 3	0.13	N		0.27	WNW	4	ESE
6/16	0.30	NNW	*	0.15	NNW	4.5	ESE
7/30	0.16	N	*	0.67	NNW	11	SE
8/25	0.87	NNE	*	0.57	NNW	11	SE
9/23				0.59	SW	11	SE
11/ 3				0.43	N		
11/11				0.39	SW	10-13	SE
12/15				0.39	WSW	2	NE
1988							
1/20				0.35	SSW	8	E
3/ 1				0.43	W	10	SW

* Field notes indicate that the drogues outsailed the waste field.
** No drogues were used. The waste field, itself, was tracked.

Table A.2.2. Monthly Current Flow Vectors Near the Dumpsite. The direction of current flow near the proposed dumpsite is listed by the month in which the measurement was made. The symbol M indicates an average through the water column from 3 to 20 m measured by a current meter deployed from a drifting vessel. D indicates the net drift of drogues deployed near the surface or 3 m. W indicates that waste field, itself, was tracked.

Month	Day	Year	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	S
1	20	'88	M														
	20	'82		D													
	21	'82								D							
3	1	'88				M											
	24	'83			W												
	25	'83			D												
	28	'83			D												
4	29	'87							D&M								
6	3	'87							M	D							
	16	'87							D&M								
7	20	'82								D							
	23	'82										D					
	30	'87							M	D							
8	25	'87							M		D						
9	23	'87		M													
11	3	'87								M							
	11	'87		M													
12	15	'87			M												

months for this area. A southwesterly flow (south southwest to west) dominated from the end of September through the end of March during the local summer season. Out of a total of 24 observations considered here only two exceptions, both during the summer, were found to this seasonal pattern. On January 21 1982, based on drogue drift, and on November 3 1987, based on current meter measurement, the current flowed north instead of the expected southwesterly direction.

This indicates that there is a seasonal shift in prevailing offshore currents in the area, with the summer trend being southwest and the winter currents trending northerly. It should be noted, however, that the El Niño Southern Oscillation (ENSO), active in 1982 and 1983, although most intense off the South American Pacific coast, exerted profound effects on both atmospheric and oceanic conditions extending throughout much of the Pacific Basin. The extent to which this could have altered local circulation patterns in this area is not known. However, the data from 1987 and 1988 support the concept of a seasonal shift in current directions.

It is worth noting that current flow to the west northwest or the northwest, and to the east northeast through south, are not represented in these data, suggesting that the switch in direction is distinct.

The current meter tended to indicate a greater current speed than the 3 m drogues used in the 1987 monitoring studies. These drogues, in turn, tended to move faster than the waste field, based on field notes of the observers. A similar occurrence was noted for the surface drogues in 2 of the 6 drogue release studies reported by Soule and Oguri (1983, 1984). The surface drogues in all of the earlier studies also outsailed the 10 and 20 m drogues deployed during the 1982 and 1983 studies; the deeper drogues had a lesser tendency to drift out of the field. Should drogues again be used, a 10 m depth is recommended.

Neither the current meter nor the three meter drogues were capable of giving acceptably accurate estimates of the speed of movement of the waste field, both indicating higher current speeds than occurred in the field. Both were essentially adequate for indications of the direction of flow.

3.b. Water Quality Parameters

As reported in the summary report for ocean dumping permit OD 86-01, (Appendix A.1.) neither temperature nor salinity were expected to vary significantly through the water column to the depths measured and these parameters remained essentially constant for each cruise reported. There was no evidence of a thermocline or other vertical discontinuity over the depths and locations measured during the period of monitoring.

The station pattern described in the permit resulted in water quality stations, being outside the waste field, with few exceptions. The data, therefore, more adequately represent oceanic background conditions rather than the dispersing and diluting waste field.

Among the instrumentally measured parameters only percent light transmittance appears to consistently reflect the presence of the waste and this is limited to Stations 2 and 3. Beyond this there is no clear indication that beam transmittance reflects the presence of the waste. The satellite stations, in general, show some reductions in transmittance occasionally, perhaps indicating the breakup of the plume due to winds or heavy seas.

Both dissolved oxygen and pH fall within the background range of values found at the stations occupied before the start of dumping in almost all instances when these parameters were measured. There is no consistent or significant relationship detectable between either of these parameters and changes in beam transmittance.

The above discussion suggests that optical measurements and observations, including the unaided human eye, appear to be the most adequate means among those used to determine the presence of the waste field and that the electronic measurements are of marginal value. This suggests that the waste field dissipates more rapidly than the monitoring plan allowed for, or in a different shape, and that some other parameter should be used to detect the presence and concentration of the wastes.

Among the ancillary chemical data reported for cruises under OD 87-01, there are no indications that clearly set these data apart from similar measurements made for the monitoring carried out under ocean dumping permit OD 86-01. Chemical data are presented in Section III.A.

3.c. Marine Organisms Sighted

The biotic sightings are summarized in Table A.2.3. for observations during monitoring cruises conducted for this permit. During all monitoring cruises there were sightings of birds, primarily terns and boobies, occurring either as schools or as single or pairs of birds. White-tailed tropic birds were seen as a pair and singly during the cruises of January 20 1988 and March 1 1988. Two frigate birds were reported on January 20. Schools of skipjack were also sighted on cruises during September, November and December 1987. A shark was reported in September and three pilot whales were seen in December. The lack of trained personnel who could consistently identify the organisms is shown in the data by the notation "birds" without any other indication of identity.

The area is relatively depauperate of visible fauna. This was also noted by Soule and Oguri (1983, 1984) for their cruises in the area during 1982 and 1983 and in the summary report for the monitoring conducted in

Table A.2.3. Biotic Observations Near the Dumpsite, September 23, 1987 to March 1 1988.

Date	Birds Number	Species	Fish Number	Species	Other animals Number	Species
1987						
Sept 23	2 Schools	Black & white birds	2 Schools	Skipjack	1	Shark
	–	Birds				
Nov 11	50	Terns (Gygis alba)	4 Schools	Skipjack (Euthynnus pelamis)		
	–	Birds				
Dec 15	2	Frigate birds (Fregata minor)	3 Schools	Skipjack (Euthynnus pelamis)	3	Pilot whales
	4	Brown boobies (Sula leucogaster)				
	50	Terns (Gygis alba)				
1988						
Jan 20	2	Frigate birds (Fregata minor)				
	2	White-tailed tropic birds birds (Phaethon lepturus)				
March 1	3	White terns (Gygis alba pacifica)				
	1	White-tailed tropic birds (Phaethon lepturus)				
	1	Brown noddy tern (Anous stolidus pileatus)				
	1	Brown booby (Sula leucogaster)				
	1 School	White terns and noddies				

partial fulfillment of ocean dumping permit OD 86-01 during the period of April through August, 1987.

4. CONCLUSIONS

1. Among the parameters routinely measured during this series of monitoring cruises, none were totally adequate for identifying and quantifying the waste field.
2. There is very little macrobiota to be affected by the waste discharge. The field appears to be neither an attractant nor a repellent to indigenous species.

5. RECOMMENDATIONS

1. A station pattern based on visual determination of the extent and advance of the leading edge of the waste field, and water quality stations at timed intervals within the most dense part of the field apparently would yield more pertinent data on the fate of the wastes and their concentration.
2. Simplification of the monitoring requirements to eliminate parameters that are of little significance or are inadequate to define the presence and concentration of the waste would ease the difficulties of carrying out a high technology program in a low tech milieu. Substitution with better indicators such as ammonia-N that can be more adequately determined under the ambient conditions is advisable.

APPENDIX A.3

BIOASSAYS OF CANNERY WASTE

from

Star-Kist Samoa and Samoa Packing Co

1987

1. INTRODUCTION

In partial fulfillment of the conditions required for ocean dumping permit OD 86-01, three sets of bioassay tests were performed on sludge wastes from Star-Kist Samoa, from Samoa Packing Co., and from the holding tank aboard the MS *Azuma Maru*, the dump vessel. The tank aboard the dump vessel held about 24,000 gallons of a load consisting of approximately equal parts of waste to be ocean dumped from Star-Kist Samoa and from Samoa Packing.

The results of the three test series were reported in some detail earlier (SOS-Environmental, Inc., 1987f, 1987g, 1987h). This report reviews the findings of those reports and summarizes the results.

2. METHODS

Sludge samples were taken on May 13, July 30 and August 25 1987. The waste samples were packed in plastic bags, frozen and air-shipped to Los Angeles. They were maintained frozen until shortly before testing. Each sample was then rapidly thawed in a microwave oven and thoroughly mixed prior to preparation of the test solutions. Dilution water, control tank water and water used for holding the organisms prior to the start of tests was collected from off Santa Catalina Island in the San Pedro Channel.

A standard toxicant, sodium dodecyl sulfate, was also tested in parallel with each of the test series.

Tests were conducted at $20^{o}\pm1^{o}C$. A 12 hour dark and light cycle was maintained during the tests. Aeration at a uniform rate was maintained in all tanks.

The fish used as test organisms were *Fundulus parvipinnis*, the California killifish, collected from the Venice canal area or from Alamitos Bay. Mysid shrimp, *Acanthomysis sculpta*, were collected from Abalone Cove, Santa Catalina Island. *Acartia* sp., a planktonic copepod, and the isopod, *Eurydice caudata*, were collected by plankton net from outer Los Angeles Harbor or from San Pedro Channel.

All animals were acclimated for at least one day prior to the start of tests. Feeding was suspended during the tests for all organisms except the *Acanthomysis sculpta*; the latter were fed daily or every other day to prevent cannabilism and mortality due to starvation. With all species, test organisms were selected of relatively uniform small size to avoid using organisms approaching the end of their natural life span.

3. RESULTS AND DISCUSSION

The LC_{50} data for all three series of tests, including parallel testing of a standard toxicant, sodium dodecyl sulfate, are presented in Tables A.3.1-12. Included in Table A.3.13 for reference are data from a 1980 bioassay test series conducted on Star-Kist Samoa waste (Soule and Oguri, 1983). Data are also included for the first test series conducted using *Acartia* sp. as a test organism. As shown in Table A.3.13, repeated attempts to obtain 90% control survival for each of the *Acartia* tests were not successful. With the permission of EPA Region 9, *Eurydice caudata* was substituted for *Acartia* sp. and subsequent testing yielded adequate control survival.

The mixed sample, representing the material that was actually ocean dumped, yields data in these tests that are of more operational significance than the results of either component. These data indicate that the LC_{50} of the material was essentially similar throughout the three test series for each species. Twofold differences in LC_{50} occurred for *Fundulus* and for *Acanthomysis*, but this is not significant. *Acanthomysis sculpta* was the most sensitive of the test species and *Eurydice caudata* was the least sensative in all of the test series.

Table A.3.1. Bioassay Test #1. Star-Kist Samoa Waste.

Sample collected: 13 May 1987   Test Dates: Fundulus 15-19 June 1987
Acanthomysis 29 June-3 July 1987
Eurydice 3-7 August 1987

Table 1A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	8	18	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	10	8	18						
72	10	10	20	10	10	20	10	10	20	9	8	17						
96	10	10	20	10	10	20	10	10	20	9	8	17						

LC50 = 0.31% (95% Confidence limits = 0.26%-0.35%)

Table 1B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	7	7	14	2	6	8	0	0	0	0	0	0
48	10	10	20	10	10	20	7	7	14	1	2	3						
72	10	10	20	8	9	17	7	6	13	0	1	1						
96	10	10	20	8	8	16	7	5	12		0	0						

LC50 = 0.11% (95% Confidence limits = 0.09%-0.14%)

Table 1C. Eurydice caudata Survival

Conc.	Control			0.6%			1.25%			2.5%			5.0%			10.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	0	0	0						
72	10	10	20	10	10	20	10	10	20									
96	10	10	20	10	10	20	10	8	18									

LC50 = 1.56% (95% Confidence limits = 1.33%-1.83%)

Table A.3.2. Bioassay Test #1. Samoa Packing Waste.

Sample collected: 14 May 1987

Test Dates: Fundulus 11-15 June 1987
Acanthomysis 29 June-3 July 1987
Eurydice 3-7 August 1987

Table 2A. Funsulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	9	9	18	1	6	7
48	10	10	20	10	10	20	10	10	20	10	10	20	8	9	17	0	5	5
72	10	10	20	10	10	20	10	10	20	10	10	20	8	9	17		5	5
96	10	9	19	10	10	20	10	10	20	10	10	20	8	9	17		5	5

LC50 = 0.76% (95% Confidence interval = 0.63%-0.93%)

Table 2B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	6	2	8	0	3	3
48	10	10	20	10	10	20	10	10	20	9	7	16	5	2	7		3	3
72	10	9	19	8	10	18	8	9	17	8	5	13	5	2	7		2	2
96	10	9	19	7	10	17	7	8	15	5	5	10	5	1	6		0	0

LC50 = 0.23% (95% Confidence interval = 0.17%-0.31%)

Table 2C. Eurydice caudata Survival

Conc.	Control			0.6%			1.25%			2.5%			5.0%			10.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	4	7	11	2	0	2
48	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0	0		0
72	10	10	20	10	10	20	10	10	20	10	10	20						
96	10	10	20	8	9	17	10	9	19	10	9	19						

LC50 = 2.78% (95% Confidence interval = 2.20%-3.51%)

Table A.3.3. Bioassay Test #1. Mixed Star-Kist Samoa and Samoa Packing Waste.

Sample collected: 13 May 1987 Test Dates: Fundulus 22-27 June 1987
Acanthomysis 29 June-3 July 1987
Eurydice 3-7 August 1987

Table 3A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	9	19	8	10	18	3	0	3
48	10	10	20	10	8	18	10	10	20	10	9	19	8	10	18	0		0
72	10	10	20	10	8	18	10	10	20	10	9	19	8	10	18			
96	10	10	20	10	8	18	10	10	20	10	9	19	8	10	18			

LC50 = 0.62% (95% Confidence interval = 0.45%-0.85%)

Table 3B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	9	10	19	10	10	20	10	10	20	3	7	10	0	0	0	0	0	0
48	9	10	19	10	10	20	10	10	20	3	7	10						
72	9	10	19	9	10	19	9	9	18	3	6	9						
96	9	10	19	9	10	19	6	9	15	2	6	8						

LC50 = 0.19% (95% Confidence interval = 0.15%-0.24%)

Table 3C. Eurydice caudata Survival

Conc.	Control			0.6%			1.25%			2.5%			5.0%			10.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	4	2	6	0	0	0
48	10	10	20	10	10	20	10	10	20	0	0	0	0	0	0			
72	10	10	20	10	10	20	10	10	20									
96	9	10	19	9	10	19	9	9	18									

LC50 = 1.55% (95% Confidence interval = 1.29%-1.87%)

Table A.3.4. Bioassay Test #1. Standard Toxicant.

Material tested: Sodium dodecyl sulfate
Sample prepared: 22 June 1987 Test Date: Fundulus 22-27 June 1987
Acanthomysis 29 June-3 July 1987
Eurydice 3-7 August 1987

Table 4A. Fundulus parvipinnis Survival

Conc.	Control			0.6ppm			1.25ppm			2.5ppm			5.0ppm			10.0ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	0	5	5	0	0	0
48	10	10	20	10	10	20	10	10	20	10	9	19	0	0	0			
72	10	10	20	10	10	20	10	10	20	10	9	19						
96	10	10	20	10	10	20	10	10	20	10	9	19						

LC50 = 3.25 ppm (95% Confidence interval = 2.83-3.74 ppm)

Table 4B. Acanthomysis sculpta Survival

Conc.	Control			0.6ppm			1.25ppm			2.5ppm			5.0ppm			10.0ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	7	17
48	10	10	20	10	10	20	10	10	20	9	9	18	7	7	14	2	3	5
72	10	10	20	10	10	20	10	9	19	9	6	15	7	6	13	2	0	2
96	10	9	19	10	10	20	10	9	19	8	6	14	6	5	11	2		2

LC50 = 4.40 ppm (95% Confidence interval = 3.34-5.81 ppm)

Table 4C. Eurydice caudata Survival

Conc.	Control			6.0ppm			12.5ppm			25ppm			50ppm			100ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
48	10	10	20	10	10	20	10	10	20	10	10	20	10	9	19	10	9	19
72	10	10	20	10	10	20	10	10	20	10	10	20	10	9	19	8	9	17
96	10	10	20	10	10	20	10	7	17	10	10	20	10	9	19	7	6	13

LC50 = 125.28 ppm (95% Confidence interval = 81.61-192.30 ppm)

Table A.3.5. Bioassay Test #2. Star-Kist Samoa Waste

Sample collected: 30 July 1987 Test Dates: Fundulus 10-14 August 1987
Acanthomysis 10-14 August 1987
Eurydice 24-28 August 1987

Table 5A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	9	10	19	10	10	20	3	8	11	0	0	0
48	10	10	20	10	10	20	9	10	19	10	10	20	0	5	5			
72	10	10	20	10	10	20	9	10	19	10	10	20		5	5			
96	10	10	20	10	10	20	9	10	19	10	10	20		5	5			

LC50 = 0.40% (95% Confidence limits = 0.33%-0.47%)

Table 5B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	9	10	19	8	10	18	8	8	16	6	7	13	0	0	0
48	10	10	20	8	9	17	8	8	16	8	6	14	4	6	10			
72	10	10	20	7	9	16	8	8	16	7	5	12	3	4	7			
96	10	10	20	7	9	16	5	6	11	4	4	8	3	3	6			

LC50 = 0.17% (95% Confidence limits = 0.12%-0.24%)

Table 5C. Eurydice caudata Survival

Conc.	Control			0.3%			0.6%			1.25%			2.5%			5.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	9	10	19
48	9	10	19	10	10	20	10	10	20	10	10	20	0	2	2	0	0	0
72	9	10	19	10	10	20	10	10	20	9	10	19		2	2			
96	9	10	19	10	10	20	9	10	19	7	8	15		2	2			

LC50 = 1.58% (95% Confidence limits = 1.31%-1.89%)

Table A.3.6. Bioassay Test #2. Samoa Packing Waste.

Sample collected: 30 July 1987 Test Dates: Fundulus 10-14 August 1987
Acanthomysis 10-14 August 1987
Eurydice 24-28 August 1987

Table 6A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	5	0	5	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	3		3						
72	10	10	20	10	10	20	10	10	20	3		3						
96	10	10	20	10	10	20	10	10	20	3		3						

LC50 = 0.21% (95% Confidence interval = 0.18%-0.24%)

Table 6B. Acanthomysis sculpta Survival

Conc.	Control			0.015%			0.03%			0.06%			0.125%			0.25%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	4	0	4	2	2	4	0	0	0
48	10	10	20	10	10	20	10	10	20	3		3	0	2	2			
72	10	10	20	10	10	20	10	10	20	2		2		1	1			
96	10	10	20	10	10	20	8	7	15	0		0		1	1			

LC50 = 0.04% (95% Confidence interval = 0.03%-0.05%)

Table 6C. Eurydice caudata Survival

Conc.	Control			0.125%			0.25%			0.5%			1.0%			10.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	0	2	2
48	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20		0	0
72	10	10	20	10	9	19	10	10	20	10	10	20	7	6	13			
96	10	10	20	9	9	18	10	10	20	10	10	20	3	2	5			

LC50 = 0.75% (95% Confidence interval = 0.60%-0.94%)

Table A.3.7. Bioassay Test #2. Mixed Star-Kist Samoa and Samoa Packing Waste.

Sample collected: 30 July 1987

Test Dates: Fundulus 17-21 August 1987
Acanthomysis 10-14 August 1987
Eurydice 24-28 August 1987

Table 7A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	9	19	0	0	0	0	0	0
48	10	10	20	10	8	18	10	10	20	10	9	19						
72	10	10	20	10	8	18	10	10	20	10	9	19						
96	10	10	20	10	8	18	10	10	20	9	8	17						

LC50 = 0.31% (95% Confidence interval = 0.26%-0.35%)

Table 7B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	9	19	7	6	13	1	0	1	0	0	0
48	10	10	20	9	10	19	8	4	12	3	4	7	1		1			
72	10	9	19	8	10	18	8	4	12	3	3	6	0		0			
96	10	9	19	7	8	15	7	4	11	3	3	6						

LC50 = 0.13% (95% Confidence interval = 0.10%-0.17%)

Table 7C. Eurydice caudata Survival

Conc.	Control			0.3%			0.6%			1.25%			2.5%			10.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0
48	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0			
72	10	10	20	10	10	20	9	10	19	10	10	20						
96	9	10	19	10	9	19	9	9	18	5	6	11						

LC50 = 1.21% (95% Confidence interval = 0.99%-1.47%)

Table A.3.8. Bioassay Test #2. Standard Toxicant.

Material tested: Sodium dodecyl sulfate
Sample prepared: 21 September 1987 Test Dates: Fundulus 5-9 October 1987
Acanthomysis 23-28 September 1987
Eurydice 5-9 October 1987

Table 8A. Fundulus parvipinnis Survival

Conc.	Control			0.6ppm			1.25ppm			2.5ppm			5.0ppm			10.0ppm		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	4	0	4	0	0	0
48	10	10	20	10	10	20	10	10	20	10	9	19	2		2			
72	10	10	20	10	10	20	10	10	20	10	8	18	2		2			
96	10	10	20	10	10	20	10	10	20	9	8	17	2		2			

LC50 = 3.41 ppm (95% Confidence interval = 2.93 ppm-3.96 ppm)

Table 8B. Acanthomysis sculpta Survival

Conc.	Control			1.25ppm			2.5ppm			5.0ppm			10.0ppm			20.0ppm		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	9	10	19	8	7	15	3	6	9
48	10	10	20	10	10	20	10	10	20	9	9	18	8	7	15	0	3	3
72	10	10	20	10	10	20	10	9	19	9	9	18	8	3	11		2	2
96	10	10	20	9	9	18	9	9	18	7	8	15	6	2	8		1	1

LC50 = 7.05 ppm (95% Confidence interval = 5.30 ppm-9.37 ppm)

Table 8C. Eurydice caudata Survival

Conc.	Control			12.5 ppm			25 ppm			50 ppm			100 ppm			200 ppm		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	2	4	6
48	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	0	2	2
72	10	10	20	10	10	20	10	10	20	10	10	20	9	9	18	4	2	6
96	10	10	20	10	10	20	10	9	19	9	9	18	9	7	16	4	2	6

LC50 = 119.28 ppm (95% Confidence interval = 93.10 ppm-152.81 ppm)

Table A.3.9. Bioassay Test #3. Star-Kist Samoa Waste.

Sample collected: 25 August 1987 Test Dates: Fundulus 12-16 October 1987
Acanthomysis 23-27 September 1987
Eurydice 5-9 October 1987

Table 9A. Fundulus parvipinnis Survival

Conc.	Control			0.03%			0.06%			0.125%			0.25%			0.5%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	9	10	19						
72	10	10	20	10	10	20	10	10	20	9	10	19						
96	10	10	20	10	10	20	10	10	20	9	10	19						

LC50 = 0.16% (95% Confidence limits = 0.14%-0.19%)

Table 9B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	9	10	19	8	8	16	0	0	0	0	0	0	0	0	0
48	10	10	20	9	9	18	6	7	13									
72	10	10	20	8	8	16	5	6	11									
96	10	10	20	8	8	16	4	4	8									

LC50 = 0.10% (95% Confidence limits = 0.08%-0.12%)

Table 9C. Eurydice caudata Survival

Conc.	Control			0.3%			0.6%			1.25%			2.5%			5.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	10	10	20						
72	10	10	20	10	10	20	10	10	20	7	10	17						
96	10	10	20	10	10	20	10	10	20	5	8	13						

LC50 = 1.36% (95% Confidence limits = 1.19%-1.55%)

Table A.3.10. Bioassay Test #3. Samoa Packing Waste.

Sample collected: 25 August 1987 Test Dates: Fundulus 28 Sept-2 Oct. 1987
Acanthomysis 23-27 Sept. 1987
Eurydice 5-9 October 1987

Table 10A. Fundulus parvipinnis Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	9	10	19	0	8	8	0	0	0	0	0	0
48	10	10	20	10	10	20	9	10	19		8	8						
72	10	10	20	10	10	20	9	10	19		8	8						
96	10	10	20	10	10	20	9	10	19		8	8						

LC50 = 0.22% (95% Confidence interval = 0.19%-0.26%)

Table 10B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.05%			1.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	9	19	9	4	13	0	3	3	0	0	0
48	10	10	20	10	10	20	10	8	18	6	3	9		0	0			
72	10	10	20	10	10	20	10	7	17	6	0	6						
96	10	10	20	10	10	20	10	6	16	6		6						

LC50 = 0.17% (95% Confidence interval = 0.14%-0.21%)

Table 10C. Eurydice caudata Survival

Conc.	Control			0.3%			0.6%			1.25%			2.50%			5.0%		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	8	10	18	0	0	0
48	10	10	20	10	10	20	10	10	20	10	10	20	8	10	18			0
72	10	10	20	10	10	20	10	10	20	10	10	20	6	10	16			
96	10	10	20	10	10	20	10	10	20	10	9	19	3	7	10			

LC50 = 2.38% (95% Confidence interval = 2.03%-2.81%)

Table A.3.11. Bioassay Test #3. Mixed Star-Kist Samoa and Samoa Packing Waste.

Sample collected: 25 August 1987   Test Dates: Fundulus 12-16 October 1987
Acanthomysis 23-28 Sept. 1987
Eurydice 5-9 October 1987

Table 11A. Fundulus parvipinnis Survival

Conc.	Control			0.125%			0.25%			0.5%			1.0%			2.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	9	10	19	10	10	20	9	10	19	8	6	14
48	10	10	20	10	10	20	9	10	19	9	9	18	3	2	5	0	0	0
72	10	10	20	10	10	20	9	10	19	8	9	17	3	1	4			
96	10	10	20	10	10	20	9	10	19	8	9	17	2	1	3			

LC50 = 0.67% (95% Confidence interval = 0.56%-0.80%)

Table 11B. Acanthomysis sculpta Survival

Conc.	Control			0.06%			0.125%			0.25%			0.5%			1.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	9	10	19	9	9	18	6	5	1	1	0	1
48	10	10	20	9	10	19	9	10	19	7	9	16	0	4	1	0		0
72	10	10	20	9	10	19	8	10	18	7	7	14		4	0			
96	9	10	19	9	8	17	8	10	18	7	6	13		2				

LC50 = 0.27% (95% Confidence interval = 0..22%-0.34%)

Table 11C. Eurydice caudata Survival

Conc.	Control			0.3%			0.6%			1.25%			2.5%			5.0%		
Tank Hours	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	0	0	0	0	0	0
48	10	10	20	10	10	20	10	10	20	10	10	20						
72	10	10	20	10	10	20	10	10	20	10	10	20						
96	10	10	20	10	10	20	10	10	20	9	9	18						

LC50 = 1.55% (95% Confidence interval = 1.29%-1.87%)

Table A.3.12. Bioassay Test #3. Standard Toxicant.

Material tested: Sodium dodecyl sulfate
Sample prepared: 21 September 1987 Test Date: Fundulus 5-9 October 1987
Acanthomysis 23-28 Sept. 1987
Eurydice 5-9 October 1987

Table 12A. Fundulus parvipinnis Survival

Conc.	Control			0.6ppm			1.25ppm			2.5ppm			5.0ppm			10.0ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	1	9	10	0	0	0
48	10	10	20	10	10	20	10	10	20	10	10	20	0	1	1			
72	10	10	20	10	10	20	10	10	20	10	10	20		1	1			
96	10	10	20	10	10	20	10	10	20	10	10	20		1	1			

LC50 = 3.79 ppm (95% Confidence interval = 2.68 ppm-5.34 ppm)

Table 12B. Acanthomysis sculpta Survival

Conc.	Control			1.25ppm			2.5ppm			5.0ppm			10.0ppm			20.0ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	8	7	15	1	0	1
48	10	10	20	10	10	20	10	10	20	8	10	18	4	4	8	0		0
72	10	10	20	10	10	20	10	10	20	7	10	17	4	3	7			
96	10	10	20	10	9	19	10	10	20	7	10	17	4	3	7			

LC50 = 7.62 ppm (95% Confidence interval = 6.14 ppm-9.47 ppm)

Table 12C. Eurydice caudata Survival

Conc.	Control			25 ppm			50 ppm			100 ppm			200 ppm			400 ppm		
Tank	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Hours																		
0	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20
24	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	5	2	7
48	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	5	0	5
72	10	10	20	10	10	20	10	10	20	10	10	20	10	10	20	4		4
96	10	10	20	10	10	20	10	10	20	9	9	18	10	10	20	4		4

LC50 = 306.27 ppm (95% Confidence interval = 241.98 ppm-387.64 ppm)

Table A.3.13. Samoa Cannery Waste Bioassays - Summary of LC50 Values in Percent from the 1987 Series and from Previous Tests of Star-Kist Samoa Samples. Survival Data and Data from Series 1 Tests using Acartia are Included.

Organism	Test series	Star-Kist Samoa	Samoa Packing	Mixed sample	Standard toxicant	S-K Samo 1983
Fundulus	1	0.31	0.76	0.62	3.25ppm	0.460
parvipinnis	2	0.40	0.21	0.31	3.41ppm	
	3	0.16	0.22	0.67	3.79ppm	
Acanthomysis	1	0.11	0.23	0.19	4.40ppm	0.040
sculpta	2	0.17	0.04	0.13	7.05ppm	
	3	0.10	0.17	0.27	7.62ppm	
Eurydice	1	1.56	2.78	1.55	125.28ppm	
caudata	2	1.58	0.75	1.21	119.28ppm	
	3	1.36	2.38	1.55	306.27ppm	
Acartia 1	1	0.018	0.023	0.036	1.334ppm	0.046
sp. 2	1	0.008		0.010	0.508ppm	
3	1	0.018		0.029	0.932ppm	
Acartia 1	1	90	95	85	80	90
control 2	1	65		65	50	
survival 3	1	70		70	70	

Greater variability occurred between the results of the different series of tests of the samples from the canneries themselves, but this apparently averaged out in the mixed samples from the dump vessel.

The data for the *Fundulus parvipinnis* tests showed similar overall LC_{50} values with no essential change from the earlier value of 0.46% (Soule and Oguri, 1983). *Acanthomysis sculpta* tests show tolerance for the wastes about five times greater than that exhibited by this species compared to the earlier test value of 0.04%. The abortive tests with *Acartia* sp. show a slightly reduced LC_{50} as compared to the earlier datum in the tests with control survival at least approaching acceptable percentages.

4. BIOASSAY CONCLUSIONS

1. *Acanthomysis sculpta* is the most sensitive of the test species for all of the test samples. *Eurydice caudata* was the least sensitive.
2. The samples submitted for test series 1 and 3 showed the Samoa Packing samples to be less toxic than the Star-Kist Samoa samples by a factor of less than two.
3. The mixed sample displayed similar values for LC_{50} in all three test series for each species.
4. In comparison to earlier data *Fundulus* showed similar values of LC_{50} and *Acanthomysis* was five times less sensitive.

5. FEDERAL REGULATORY COMPLIANCE

As required by the Marine Protection, Research and Sanctuaries Act (92-532) of 1972 and Final Revisions of Regulations and Criteria on Ocean Dumping (FR 42, January 11, 1977, Part 227) the constraints on ocean disposal are to be determined based on the demonstrated toxicity of the waste.

5.a. Limiting Permissable Concentration (227.27(a)(2))

Bioassay tests were conducted on the wastes from Star-Kist Samoa, Samoa Packing and samples of the two wastes mixed in the holding tank of the disposal vessel prior to ocean dumping (SOS Environmental Inc., 1987 f,g,h,). These tests, conducted in three separate series used *Fundulus parvipinnis*, the California killifish, *Acanthomysis sculpta*, a mysid shrimp, and *Eurydice caudata*, a planktonic isopod, as test species. The most sensitive of the organisms was *Acanthomysis*, as it was in earlier tests (Soule and Oguri, 1983). The earler tests reported an LC_{50} for Acanthomysis as 0.04% of the Star-Kist waste tested at that time. The present testing showed a range of Lc_{50} values for *Acanthomysis* for the three waste samples of 0.04% for Samoa Packing test series 2, to 0.27% for the mixed sample test series 3, as shown in table 1.

The Limiting Permissable Concentration (LPC), based on the worst case, that of Samoa Packing Co. test series 2, is 0.01 X 0.04% or 0.0004% concentration of the waste, unchanged from the earlier value. If the calculation of the LPC is based on the worst case of the material to be dumped, the mixed sample, the LPC becomes 0.0013% concentration of the waste.

5.b. Release Zone (227.28)

The release zone, "...the area swept by the locus of points 100 meters from the perimeter of the conveyance...", is 100 meters plus 8.1 meters, the beam of the dump vessel, MV *Azuma Maru*, plus 100 meters, or 208.1 meters in width. The length of the release zone is based on the capacity of the dump vessel, the rate at which her tank is pumped and the speed of the vessel during dumping operations. The pumping rate, 140 gallons per minute per knot at 5 knots equals 700 gallons per minute.

This would require 34.3 minutes to empty the 24,000 gallon tank aboard the vessel. The vessel at 5 knots would cover 5.3 kilometers in that period. The area of the release zone, based on width multiplied by length is 1,102,930 m^2.

5c. Initial Mixing (227.29)

In the absence of a detectable thermocline within 20 meters of the surface in the area of the proposed dumpsite (Soule and Oguri, 1983), the depth of the initial mixing volume is assumed to be 20 meters. The initial mixing volume is, therefore, 20 X the release zone area, or 22,058,600 m^3.

6. CONCLUSTION 227.29 (a)

The concentration of the waste within the initial mixing volume will average 24,000 gallons, the capacity of the tank aboard the dump vessel, through the initial mixing volume of 22.06×10^6 m^3 to yield an overall concentration of 0.0004%, the limiting permissable concentration.

If the entire dumpsite area, a circle 1.5 nautical miles in diameter is considered as the release zone, with an area of 6.06 km^2 and an initial mixing volume of 121,222,814 m^3, the concentration of waste would be 0.000075%, well below the limiting permissable concentration.

The theoretical capacity of the dumpsite is 128,000 gals, which is adequate to accommodate the planned increase in capacity of the dump vessel to about 50,000 gals.

APPENDIX B

MATHEMATICAL MODELING

OF FISH WASTE DISPOSAL IN DEEP WATER

1. INTRODUCTION

The purpose of this study is to predict the fate of fish processing wastes which are discharged at the present dumpsite off Tutuila Island, American Samoa in the South Pacific. The center point of the 1.5 nautical mile (n mi) diameter dumpsite is located at 170°40.87'W and 14°22.18'S. and is about 3.3 n mi due east of Sail Rock Point on Tutuila Island.

The preferred dumpsite selected in the FEIS is located at 170°38.30'W and 14°24.00'S, southeast of the present site. The model studies in this section were performed using the present site and known oceanographic conditions and waste characteristics, but the results are equally applicable to the preferred site under present waste loadings.

The waste is expected to undergo rapid initial mixing after discharge. Since the gross bulk density of the fish waste is between 0.72 and 0.99 gm/ml, the majority of the plume will remain near the ocean surface immediately after being discharged from the ship. Since the model developed by Koh and Chang (1973) was designed to simulate disposal of wastes that are heavier than the sea water, a new mathematical model has been formulated specifically for this study to predict the fate of the floating plume. This model can simulate the diffusion (lateral and vertical) and settling of the waste particles while the plume is advected in the direction of the ambient current. Most of the data used in the simulations were obtained from the reports published by Soule and Oguri (1983 and 1984) but subsequent monitoring data in 1987 and 1988 (See Appendix A) are consistent with the previously published data. The results of the simulations are presented in terms of dilution as a function of time after discharge, and/or distance and time from the discharge location. The simulations have been performed for two density profiles (summer and winter), three ambient currents (0.2, 0.4, and 0.8 knots), and three particle settling velocities (1, 0.1, and 0.01 cm/sec). The waste plume is advected downstream by the ambient current. The direction of the ambient current varies with the season and the time of measurement. Some drogue studies by Soule and Oguri (1984) indicate movement toward the southwest direction while some 1987 current meter data indicate movement in the northwest direction. A close examination of the current direction based on the data published in the U.S. Navy Marine Climatic Atlas of the World (1979) for the region under study also indicates a SW direction. The prevailing south equatorial current indicates the direction is from SE toward NW. In order to cover several possible scenarios several current directions are used for simulation.

Since no data were ascertained for the settling velocity of the waste particles of the Samoa plant, velocities of 1, 0.1, and 0.01 cm/sec have been used in the calculations to cover the possible range of settling velocities. It is possible to distinguish the waste particles into three categories according to the density of the particles: (a) particles that are buoyant will form a thin layer floating at the ocean surface; (b) particles that are neutrally buoyant will be mixed and dispersed within the mixed layer (the mixed layer is the surface layer of the ocean extending from the ocean surface to the thermocline); (c) particles that are heavier than sea water will sink as the layer of waste particles is advected by the ambient current.

2. DEVELOPMENT OF MATHEMATICAL MODEL

Based on the data contained in Soule and Oguri (1983), the bulk densities of the fish processing wastes generated by Star-Kist Samoa and Samoa Packing are 0.72 to 0.96 gm/ml and 0.99 gm/ml, respectively. Recent data on the specific gravity tests of the cannery waste provided to us on November 13, 1987 indicate a range of 0.99 to 1.023 gm/ml have been measured. Thus the possible settling velocity of the particulates in the plume is covered in our range of simulation. The tuna fish waste discharged from the ship is predominantly buoyant in sea water. Immediately after being discharged by the vessel pumps it undergoes rapid, near field, initial mixing similar to mixing in a jet. Because the discharge vessel circles around within the discharge zone, it is reasonable to assume that this nearfield mixing process, in combination with the ship's track and the prevailing current, would (1) establish an initial zone of width L and depth H within which the mean concentration is Co, and (2) the plume would drift downstream emanating from this initial zone. The dimension L would be expected to be approximately the turning diameter of the discharge ship. The concentration Co would correspond to the dilution obtained by the discharge jet as it is propelled downward and then returns towards the surface. The dimension H would be obtained such that where Q is the

$$U \; L \; H \; Co = Q \tag{2.1}$$

discharge rate of the tuna fish waste and U is the magnitude of the prevailing current. It can be visualized that the initial plume to be advected by the ambient current has a concentration Co with the plume width L and the plume depth extending from the ocean surface downward by a value of H.

Each discharge episode would have a duration T. We shall assume that the prevailing current can be regarded as constant during that time. Then a plume of length UT would be generated as a result of the discharge episode.

Along the length of the plume, the concentration would decrease from

Co due to lateral mixing. Longitudinal diffusion will be probably small.

Diffusion of waste effluent in an ocean current was analyzed by Brooks (1960), taking into account the increase of the eddy diffusivity as the waste field spreads.

The basic differential equation, based on the principle of conservation of mass, for the substance being diffused is:

$$\frac{\partial}{\partial y}\left(-\mathcal{E}\frac{\partial C}{\partial y}\right) + U\frac{\partial C}{\partial x} + KC = 0 \qquad (2.2)$$

where the spatial coordinate x represents longitudinal direction (in the direction of ambient current) and y represents the lateral direction. The three terms in the above equation represents the rates of concentration decay per unit volume due to lateral diffusion, longitudinal advection and apparent dieoff respectively.

Incorporating an exponential decay term to take care of the dieoff term in Equation 2.2 such as

$$C = \phi e^{-Kx/U} \qquad (2.3)$$

would transform the equation into a simpler differential equation

$$\mathcal{E}\frac{\partial^2\phi}{\partial y} = U\frac{\partial\phi}{\partial x} \qquad (2.4)$$

The function ϕ is the concentration without any dieoff effect; it is a function of x and y.

An additional change of variable: $\mathcal{E} = \mathcal{E}_o f(x)$ and $dx' = f(x)dx$ would allow one to transform Equation 2.4 to the classical heat equation as follows:

$$\mathcal{E}\frac{\partial^2\phi}{\partial y^2} = U\frac{\partial\phi}{\partial x} \qquad (2.5)$$

where $\mathcal{E}_o$ is the eddy diffusivity at x=0.

An exact solution to Equation 2.5, therefore, Equation 2.2 can easily be found as:

$$C(x,y) = \frac{Co\ e^{-Kx/U}}{2\sqrt{\pi \mathcal{E}_o t'}} \int_{-\frac{b}{2}}^{\frac{b}{2}} e^{-\frac{(y-y')^2}{4\mathcal{E}_o t'}} dy \qquad (2.6)$$

in which $t' = x'/U$ has been used, Co is the initial waste concentration at x=0, for $-b/2 < y < b/2$.

The integral in Equation 2.6 can be arranged to become the well known error function defined as

$$\text{erf } z = (2/\sqrt{\pi}) \int_0^z \exp(-\xi^2)\, d\xi \qquad (2.7)$$

We further introduce the concentration Cmax(x) as the concentration of the waste plume at y=0 and neglect the dieoff effect (i.e. set k=0.), this would yield a conservative estimation. We also assume that the lateral diffusivity can be expressed as

$$\mathcal{E} = A\, L^{4/3} \qquad (2.8)$$

where L is a length parameter proportional to the lateral width of the plume and A is a proportionality constant.

Thus, the maximum concentration at the center line of the plume can be simplified to be

$$\frac{Cmax}{Co} = \text{erf}\left\{ \left[\frac{1.5}{(1 + 8\, A\, t\, /\, L^{2/3})^{3} - 1} \right]^{1/2} \right\} \qquad (2.9)$$

The error function in Equation 2.9 has been defined in Equation 2.7, and t is defined as x/U with x denoting the distance downstream from the initial dumping location.

For the waste with settling velocity Ws, it can be readily visualized that the combination of lateral diffusion, downstream advection by current, and settling can be schematised to a very good approximation by taking an x´ coordinate inclined to the original downstream x coordinate by an angle $\theta = \tan^{-1}(Ws/U)$, as shown in Figure 2-1.

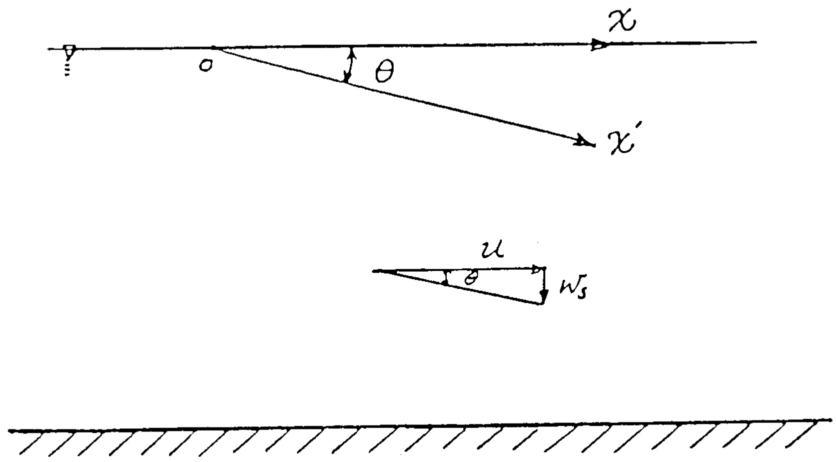

Figure 2-1. Definition sketch of the longitudinal direction with the effects of settling velocity.

Physically we are simply following the particles down with a velocity Ws while they are being advected downstream at speed U. The reduction in concentration still obeys the same formula as in Equation 2.9 except that the velocity along x' should be $U' = \sqrt{(U^2 + Ws^2)}$. But $t = x/U = x'/U'$ and hence the evaluation of Equation 2.9 needs only to be performed once for all Ws. Only the vertical location needs to be changed for each of the particle classes with differing fall velocities.

The effect of vertical diffusion can be incorporated approximately by deducing a concentration reduction factor based on vertical diffusion. For this purpose we assume Fickian diffusion with a diffusion coefficient Kv. Then it can be readily deduced that the concentration reduction factor due to vertical diffusion is approximately

$$\frac{H/4}{(2\ Kv\ t + H^2/16)^{1/2}} \qquad (2.10)$$

The quantity in the denominater is simply the characteristic vertical dimension (standard deviation) of the plume whose initial dimension is H/4. Combining this with the reduction due to lateral diffusion gives

$$\frac{Cmax}{Co} = \frac{H/4}{(2Kvt+H^2/16)^{1/2}}\ \mathrm{erf}\{\ [\ \frac{1.5}{(1 + 8At/L^{2/3})^3\ \ -\ 1}\ ]^{1/2}\ \} \qquad (2.11)$$

where the vertical location of the centroid y is

$$y\ =\ Ws\ t\ =\ Ws\ x\ /\ U \qquad (2.12)$$

The above formulation retains all the essence of the complicated diffusion process in an ocean current. It is believed that this model provides a good and valid estimate of the mixing, transport, and diffusion of the tuna fish waste.

3. RESULTS OF MATHEMATICAL MODELING

The mathematical model developed in Section 2 was used to simulate the fate of the discharged fish processing wastes with the available data. The data used in the simulations are first presented. Then the results are presented in terms of dilution as a function of time after discharge and distance from the discharge location. According to Fischer et al. (1979), dilution usually is defined as the ratio of the total volume of a sample to the volume of effluent contained in the sample. Thus the volume fraction of effluent in a sample is equal to the reciprocal of dilution.

3.1 Data used for Simulations

The following input data are obtained from Soule and Oguri (1983):

Ambient Current Velocity	0 to 0.8 knots	
Ambient Density Profiles	summer, winter	
Dumpsite Water Depth	1.46 km (800 fathoms)	
Discharge Rate	500 to 1400 gpm	
	(1.89 cu m/min to 5.30 cu m/min)	
Sludge Bulk Density	0.72 to 0.96 gm/ml	Star-Kist
	0.99 gm/ml	Van Camp
Sludge Tank Capacity	24000 gal (90.85 cu m)	
Dump Vessel Key Dimensions	Length = 49.0 m Beam = 8.1 m Draft = 3.35 m	

The radius of the dumping circle circumscribed by the dump vessel is 0.2 n mi. Also, the pumping rate of the sludge is 140 gpm per knot of vessel speed which can go up to 10 knots. Thus, for our simulation a range of discharge rates between 500 gpm and 1400 gpm is used. The discharge of the fish waste is completed within a time period during which the current direction does not change. For example, with the sludge tank capacity of 24,000 gallons and the discharge rate of 500 gpm the estimated discharge period would be 48 minutes. It is reasonable to assume that the direction of the current would not be altered during this period.

Data of the ambient current velocity in the vicinity of the dumpsite are also available from the drogue and waste plume tracking studies conducted by Soule and Oguri (1984) and 1987 permit monitoring data. According to the drogue tracking studies, the speed of the surface current ranges from 0.39 to 0.94 knots. The waste plume was observed to move at an average speed of 0.67 knots. These values of the ambient current speed are in good agreement with the values (0.4 to 0.8 knots) published in the U.S. Navy Marine Climatic Atlas of the World (1979). The prevailing surface current patterns in the South Pacific Ocean for the summer and winter seasons are shown in Figures 3-1 and 3-2, respectively. Therefore, current speeds of 0.2, 0.4, and 0.8 knots have been used in the simulations.

Two ambient density profiles have been used in the simulations to account for the summer and winter seasons. Typical sea water temperature and salinity profiles for the summer and winter seasons are shown in Tables 3-1 and 3-2, respectively. These profiles were obtained from Soule and Oguri (1983) who conducted cruise studies in the vicinity of the dumpsite. As shown in Table 3-1, the temperature data were obtained to a water depth of 24.5 m. However, a thermocline would be present in the summer season. Hence, a thermocline is assumed to be present at a water depth of about 100 - 200 m based on the data available for the Southern Pacific Ocean. The sea water temperature profile for the summer season looks like this:

0 to 100 m	same as shown in Table 3-1
100 to 200 m	a temperature gradient of $8^{o}C$ / 50 m
below 200 m	a temperature gradient of $1.2^{o}C$ / 50 m

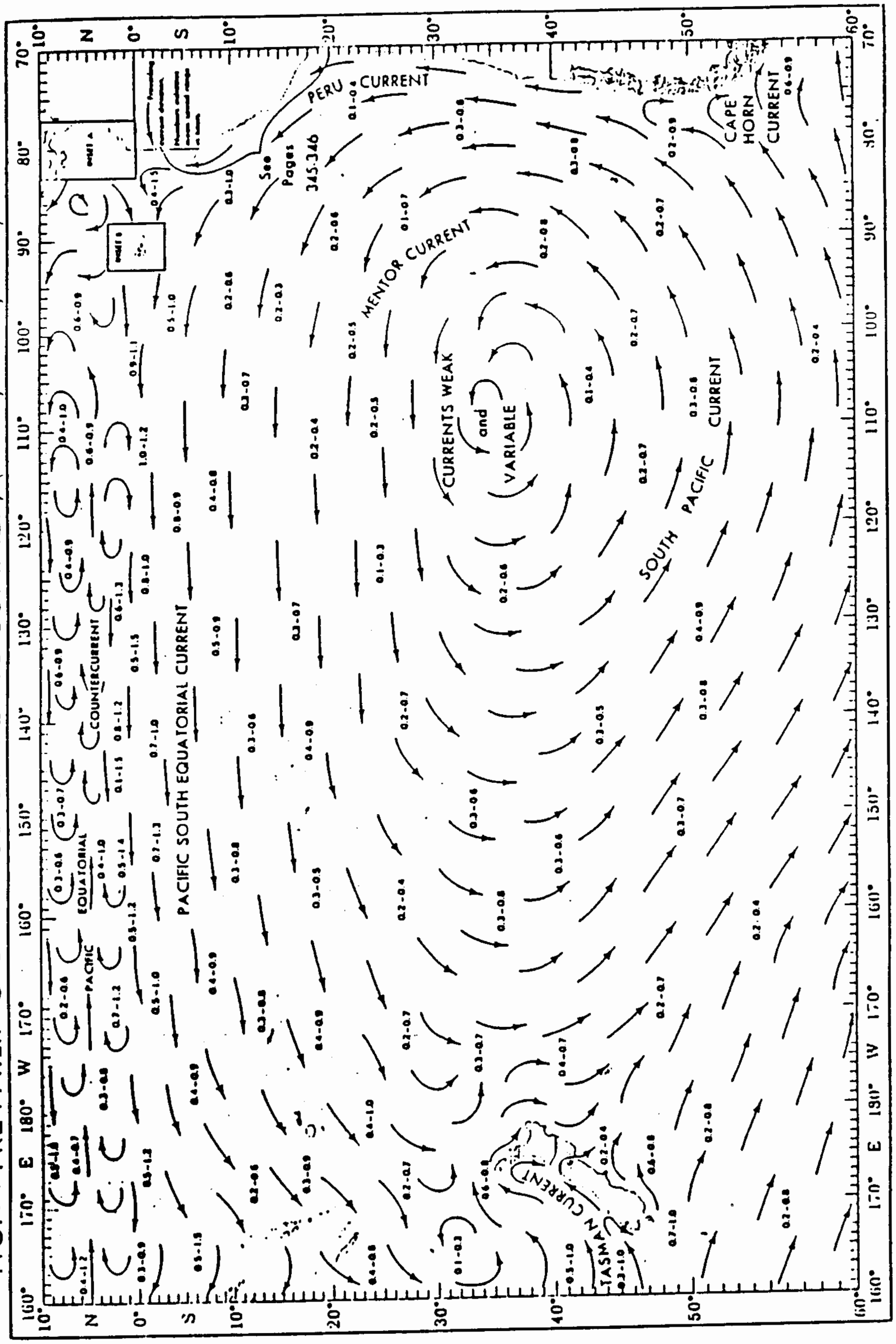

FIG. 3-1 PREVAILING SURFACE CURRENTS SUMMER, (DEC., JAN., FEB.)

FIG. 3-2 PREVAILING SURFACE CURRENTS WINTER, (JUN., JUL., AUG.)

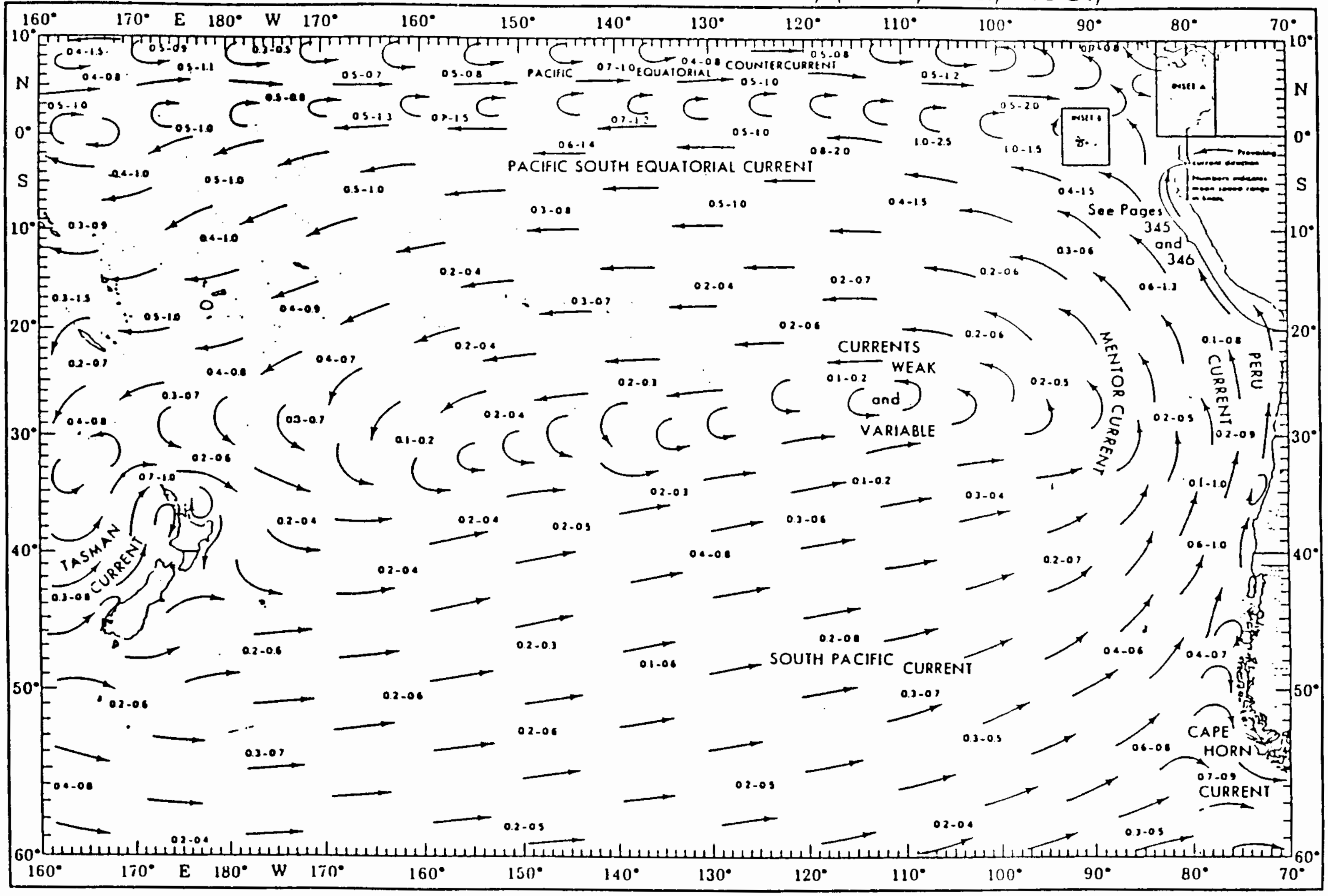

Table 3-1

CRUISE: Star-Kist - Van Camp NOAA-OMPA-AMERICAN SAMOA | VESSEL: AUTELE | DATE: 21 Jan. 1982

WEATHER: See Cruise Report | SEA STATE: See Cruise Report | TIDE: High; 1710, 2.6ft.

Station	Depth m	Time	Temp °C	Sal o/oo	DO mg/l	pH	%T	Secchi m	FU	NH_3 μg-at/l	BOD mg/l	TOC mg/l	DO Winkler
TP05	0	1045	29.8	36.3	5.9	8.4	55	3	6		4.5		5.4
	3		29.9	36.8	6.1	8.4	85				3.5		5.4
	6		29.5	37.0	6.1	8.4	90						5.6
	10		29.4	37.0	6.1	8.4	96				3		5.5
	15		29.4		6.0	8.5	98						
TS06	0	1115	29.5	36.1	5.7	8.4	87	4	4				5.4
	3		29.5	36.5	5.5	8.4	86						5.7
	6		29.4	36.5	5.8	8.4	91						5.8
	10		29.4	36.8	6.0	8.5	95						5.6
	15		29.4		5.8	8.5	96						
TS07	0	1135	29.4	36.6	5.7	8.4	90	7	3		7.5		5.6
	3		29.5	36.6	6.0	8.4	88				5		5.4
	6		29.5	36.7	5.7	8.4	91				6		5.6
	10		29.5	36.9	5.8	8.4	92				5.5		5.7
	15		29.5		5.8	8.5	94						
	20		29.4		5.8	8.5	93						
	24.5		29.4		5.8	8.5	93						

Table 3-2

CRUISE: NOAA-OMPA-Star-Kist Samoa | VESSEL: Autele | DATE: 23 July 1982

WEATHER: Hot, calm with gusts, 2-6k | SEA STATE: Long swells, 8-10ft | TIDE: Low 1530, -0.5ft

Station (Map/Site)	Depth m	Time	Temp ^oC	Sal $^o/_{oo}$	DO mg/l	pH	%T	Secchi m	FU	NH_3 µg-at/l	BOD mg/l	TOC mg/l
TS E (6)	0	1141	28.37	34.28	6.68	8.27		3	6			
	3		28.33	34.30	6.64	8.26						
	6		28.25	34.32	6.68	8.26						
	10		28.24	34.32	6.65	8.26						
	15		28.24	34.33	6.66	8.27						
	20		28.23	34.35	6.63	8.27						
* (7)												
TS F (8)	0	1157	28.59	34.25	6.62	8.25		4	4			
	3		28.29	34.31	6.66	8.26						
	6		28.26	34.31	6.41	8.26						
	10		28.25	34.32	6.41	8.27						
	15		28.25	34.32	6.51	8.27						
	20		28.25	34.32	6.41	8.27						
TS G (9)	0	1206	28.44	34.27	6.62	8.25		14	3			
	3		28.31	34.30	6.65	8.26						
	6		28.26	34.30	6.66	8.27						
	10		28.24	34.31	6.53	8.27						
	15		28.24	24.32	6.42	8.27						
	20		28.24	34.31	6.41	8.27						

*7 1151 drogues only

For water depths below 100 m, the temperature gradients have been estimated from the data shown in Figure III.11, of this volume. A temperature profile as shown in Table 3-2 has been assumed for the winter season. The temperature gradient is about 0.5^{O}C per 30.5m.

3.2 Results of Simulations

Before the simulations were performed, parameters such as A, Co, Kv, and L in Equation 2.11 need to be calculated or chosen. The parameter A is a constant called the dissipation parameter. The constant A relates the lateral diffusivity to the plume width parameter as defined in Equation 2.8. The empirical value of A in the ocean environment is generally from 0.1 to 0.0001 ft$^{2/3}$ /sec. (See Koh & Fan 1970, page 129 for presentation of such data). For the study site the exact value of A is not known. Therefore, a median value in the range just cited can be assumed. The value of A chosen for this simulation is 0.001 ft$^{2/3}$ /sec Since the exact value varies from day to day and it also depends on the currents in the study site, this chosen value is believed to be reasonable. More precise value may be obtained by field experiments.

The initial mean concentration Co of the fish wastes discharged into the ocean water through the disposal ship must be estimated based on the discharge rate. This value corresponds to the dilution obtained at the wake of the discharge ship and it can be estimated by the formula developed by Koh and Chang (1973). In their analysis they first assumed that the pumping rate of the waste material is such that the waste material is completely mixed into the wake by the turbulence without altering the wake flow pattern. Secondly, the effect of surface waves can be disregarded so that the flow pattern can be approximated from the analysis of the jet and wake flows. Thirdly, they assumed that the flow pattern approaches a similarity form at a certain distance from the discharge point. Based on the given information of the discharge vessel and the assumptions involved in deriving the Koh and Chang formula, the initial mean concentration, Co, can be estimated by the following formula:

$$Co = \frac{Q}{1.814\,\pi\,R^2\,V} \tag{3.1}$$

where Q is the discharge rate of the fish waste from the discharge pipe.

R is a characteristic length of the body which is chosen as the geometric mean of the half beam and the draft of the discharge vessel (i.e. [(ship draft) (half beam)]$^{1/2}$.

V is the relative velocity between ship and ambient current.

It should be noted that based on Equation 3.1 the scale of the mixing zone in the wake is proportional to the characteristic dimension of the discharge vessel which is reasonable.

The vertical diffusion coefficient Kv can be evaluated by the formulation of Koh and Fan (1970)

$$Kv = 10^{-4} / E \qquad \text{(sq cm/sec)} \tag{3.2}$$

and

$$E = \left| \frac{1}{\rho} \frac{d}{dy} \right| \tag{3.3}$$

where E = sea water density gradient

ρ = sea water density

y = water depth (meters)

From the temperature profiles developed in Section 3.1, the values of Kv, as shown in Table 3-3, are calculated as a function of water depth for the summer and winter seasons.

The width L of the initial plume is expected to be approximately twice the turning radius of the discharge ship. Since the turning radius

Table 3-3. Vertical Diffusion Coefficient.

Depth (m)	Kv (sq cm/sec) Summer	Kv (sq cm/sec) Winter
0 - 100	7.8	17.3
100 - 200	1.2	17.3
> 200	7.3	17.3

of the disposal vessel is 0.2 n mi (370.5 m), L is taken to be 741 m.

The results of the simulations are presented in terms of dilution of the fish wastes as a function of time after discharge and distance from the discharge location. Dilution is reciprocal of the product of Co and Cmax/Co. This value gives an indication of the volume fraction of fish waste in the water sample after the waste plume has traveled for a certain distance from the discharge location. Since no data have been obtained for the settling velocity of the Samoa waste particles, velocities of 1, 0.1, and 0.01 cm/sec have been used in the calculations to cover the possible range of settling velocities which is a function of the density of the waste material relative to the sea water density. The group of results with settling velocities of 0.01, 0.1, and 1.0 cm/sec would correspond to the particles that are floating on the ocean surface, neutrally buoyant in sea water and heavier than sea water respectively. The behavior of the particles with a settling velocity of 0.1 cm/sec is similar to that of neutrally buoyant particles and thus they are advected by the ambient surface and near surface currents.

The settling tank experiments reported by Soule and Oguri (1983) indicate that 30% of the fish waste being studied had a fall velocity greater than zero, 7% of the wastes had a fall velocity greater than 0.059 cm/sec and only 0.5% of the waste had a fall velocity greater than 0.24 cm/sec. Therefore the range of fall velocity used for the present study is reasonable. In fact, the fall velocity of 0.01 cm/sec would be the most representative value; thus, when discussing the simulated results, attention is directed toward the fall velocity of 0.01 cm/sec.

The computer model results are presented in tabular form in Tables 3-4 to 3-7 using the dimensions given for the dump vessel. Tables 3-4 and

Table 3-4. Results of Summer Waste Dilution, Q = 500 gpm.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				Vfall = 1 cm/s			Vfall = 0.1 cm/s			Vfall = 0.01 cm/s		
T(hr)	X(n mi)	U(kt)	Co	Y1(m)	Cmax/Co	Ratio	Y2(m)	Cmax/Co	Ratio	Y3(m)	Cmax/Co	Ratio
5.0	1.0	.2	.000222	180.0	.05423	.33	18.0	.04999	.36	1.8	.04999	.36
7.5	1.5	.2	.000222	270.0	.03242	.56	27.0	.03038	.59	2.7	.03038	.59
10.0	2.0	.2	.000222	360.0	.02172	.83	36.0	.02052	.88	3.6	.02052	.88
12.5	2.5	.2	.000222	450.0	.01562	1.15	45.0	.01482	1.22	4.5	.01482	1.22
15.0	3.0	.2	.000222	540.0	.01179	1.53	54.0	.01133	1.59	5.4	.01122	1.61
17.5	3.5	.2	.000222	630.0	.00922	1.95	63.0	.00947	1.90	6.3	.00880	2.05
20.0	4.0	.2	.000222	720.0	.00741	2.43	72.0	.00805	2.24	7.2	.00709	2.54
2.5	1.0	.4	.000222	90.0	.05794	.31	9.0	.05035	.36	.9	.05035	.36
3.7	1.5	.4	.000222	135.0	.03798	.47	13.5	.03430	.53	1.3	.03430	.53
5.0	2.0	.4	.000222	180.0	.02726	.66	18.0	.02507	.72	1.8	.02507	.72
6.3	2.5	.4	.000222	225.0	.02067	.87	22.5	.01920	.94	2.2	.01920	.94
7.5	3.0	.4	.000222	270.0	.01627	1.11	27.0	.01522	1.18	2.7	.01522	1.18
8.8	3.5	.4	.000222	315.0	.01317	1.37	31.5	.01238	1.46	3.1	.01238	1.46
10.0	4.0	.4	.000222	360.0	.01089	1.65	36.0	.01028	1.75	3.6	.01028	1.75
1.2	1.0	.8	.000222	45.0	.04207	.43	4.5	.04207	.43	.5	.04207	.43
1.9	1.5	.8	.000222	67.5	.03532	.51	6.8	.03183	.57	.7	.03183	.57
2.5	2.0	.8	.000222	90.0	.02859	.63	9.0	.02521	.71	.9	.02521	.71
3.1	2.5	.8	.000222	112.5	.02287	.79	11.3	.02058	.88	1.1	.02058	.88
3.7	3.0	.8	.000222	135.0	.01883	.96	13.5	.01717	1.05	1.3	.01717	1.05
4.4	3.5	.8	.000222	157.5	.01585	1.14	15.8	.01457	1.24	1.6	.01457	1.24
5.0	4.0	.8	.000222	180.0	.01355	1.33	18.0	.01254	1.44	1.8	.01254	1.44

Table 3-5. Results of Summer Waste Dilution, Q = 1400 gpm.

				Vfall = 1 cm/s			Vfall = 0.1 cm/s			Vfall = 0.01 cm/s		
T(hr)	X(n mi)	U(kt)	Co	Y1(m)	Cmax/Co	Ratio	Y2(m)	Cmax/Co	Ratio	Y3(m)	Cmax/Co	Ratio
5.0	1.0	.2	.000621	180.0	.05423	.12	18.0	.05000	.13	1.8	.05000	.13
7.5	1.5	.2	.000621	270.0	.03242	.20	27.0	.03039	.21	2.7	.03039	.21
10.0	2.0	.2	.000621	360.0	.02172	.30	36.0	.02052	.31	3.6	.02052	.31
12.5	2.5	.2	.000621	450.0	.01562	.41	45.0	.01483	.43	4.5	.01483	.43
15.0	3.0	.2	.000621	540.0	.01179	.55	54.0	.01133	.57	5.4	.01123	.57
17.5	3.5	.2	.000621	630.0	.00922	.70	63.0	.00947	.68	6.3	.00888	.73
20.0	4.0	.2	.000621	720.0	.00741	.87	72.0	.00805	.80	7.2	.00709	.91
2.5	1.0	.4	.000621	90.0	.05795	.11	9.0	.05036	.13	.9	.05036	.13
3.7	1.5	.4	.000621	135.0	.03799	.17	13.5	.03430	.19	1.3	.03430	.19
5.0	2.0	.4	.000621	180.0	.02727	.24	18.0	.02507	.26	1.8	.02507	.26
6.3	2.5	.4	.000621	225.0	.02067	.31	22.5	.01921	.34	2.2	.01921	.34
7.5	3.0	.4	.000621	270.0	.01627	.40	27.0	.01522	.42	2.7	.01522	.42
8.8	3.5	.4	.000621	315.0	.01317	.49	31.5	.01238	.52	3.1	.01238	.52
10.0	4.0	.4	.000621	360.0	.01089	.59	36.0	.01028	.63	3.6	.01028	.63
1.2	1.0	.8	.000621	45.0	.04208	.15	4.5	.04208	.15	.5	.04208	.15
1.9	1.5	.8	.000621	67.5	.03533	.18	6.8	.03184	.20	.7	.03184	.20
2.5	2.0	.8	.000621	90.0	.02859	.23	9.0	.02522	.26	.9	.02522	.26
3.1	2.5	.8	.000621	112.5	.02287	.28	11.3	.02058	.31	1.1	.02058	.31
3.7	3.0	.8	.000621	135.0	.01884	.34	13.5	.01717	.37	1.3	.01717	.37
4.4	3.5	.8	.000621	157.5	.01585	.41	15.8	.01457	.44	1.6	.01457	.44
5.0	4.0	.8	.000621	180.0	.01355	.47	18.0	.01254	.51	1.8	.01254	.51

Table 3-6. Results of Winter Waste Dilution, Q = 500 gpm.

				Vfall = 1 cm/s			Vfall = 0.1 cm/s			Vfall = 0.01 cm/s		
T(hr)	X(n mi)	U(kt)	Co	Y1(m)	Cmax/Co	Ratio	Y2(m)	Cmax/Co	Ratio	Y3(m)	Cmax/Co	Ratio
5.0	1.0	.2	.000222	180.0	.03364	.54	18.0	.03364	.54	1.8	.03364	.54
7.5	1.5	.2	.000222	270.0	.02043	.88	27.0	.02043	.88	2.7	.02043	.88
10.0	2.0	.2	.000222	360.0	.01379	1.31	36.0	.01379	1.31	3.6	.01379	1.31
12.5	2.5	.2	.000222	450.0	.00996	1.81	45.0	.00996	1.81	4.5	.00996	1.81
15.0	3.0	.2	.000222	540.0	.00754	2.39	54.0	.00754	2.39	5.4	.00754	2.39
17.5	3.5	.2	.000222	630.0	.00591	3.05	63.0	.00591	3.05	6.3	.00591	3.05
20.0	4.0	.2	.000222	720.0	.00476	3.78	72.0	.00476	3.78	7.2	.00476	3.78
2.5	1.0	.4	.000222	90.0	.03385	.53	9.0	.03385	.53	.9	.03385	.53
3.7	1.5	.4	.000222	135.0	.02305	.78	13.5	.02305	.78	1.3	.02305	.78
5.0	2.0	.4	.000222	180.0	.01684	1.07	18.0	.01684	1.07	1.8	.01684	1.07
6.3	2.5	.4	.000222	225.0	.01290	1.40	22.5	.01290	1.40	2.2	.01290	1.40
7.5	3.0	.4	.000222	270.0	.01022	1.76	27.0	.01022	1.76	2.7	.01022	1.76
8.8	3.5	.4	.000222	315.0	.00831	2.17	31.5	.00831	2.17	3.1	.00831	2.17
10.0	4.0	.4	.000222	360.0	.00690	2.61	36.0	.00690	2.61	3.6	.00690	2.61
1.2	1.0	.8	.000222	45.0	.02827	.64	4.5	.02827	.64	.5	.02827	.64
1.9	1.5	.8	.000222	67.5	.02138	.84	6.8	.02138	.84	.7	.02138	.84
2.5	2.0	.8	.000222	90.0	.01693	1.06	9.0	.01693	1.06	.9	.01693	1.06
3.1	2.5	.8	.000222	112.5	.01382	1.30	11.3	.01382	1.30	1.1	.01382	1.30
3.7	3.0	.8	.000222	135.0	.01153	1.56	13.5	.01153	1.56	1.3	.01153	1.56
4.4	3.5	.8	.000222	157.5	.00979	1.84	15.8	.00979	1.84	1.6	.00979	1.84
5.0	4.0	.8	.000222	180.0	.00842	2.14	18.0	.00842	2.14	1.8	.00842	2.14

Table 3-7. Results of Winter Waste Dilution, Q = 1400 gpm.

				Vfall = 1 cm/s			Vfall = 0.1 cm/s			Vfall = 0.01 cm/s		
T(hr)	X(n mi)	U(kt)	Co	Y1(m)	Cmax/Co	Ratio	Y2(m)	Cmax/Co	Ratio	Y3(m)	Cmax/Co	Ratio
5.0	1.0	.2	.000621	180.0	.03364	.19	18.0	.03364	.19	1.8	.03364	.19
7.5	1.5	.2	.000621	270.0	.02043	.32	27.0	.02043	.32	2.7	.02043	.32
10.0	2.0	.2	.000621	360.0	.01380	.47	36.0	.01380	.47	3.6	.01380	.47
12.5	2.5	.2	.000621	450.0	.00996	.65	45.0	.00996	.65	4.5	.00996	.65
15.0	3.0	.2	.000621	540.0	.00754	.85	54.0	.00754	.85	5.4	.00754	.85
17.5	3.5	.2	.000621	630.0	.00591	1.09	63.0	.00591	1.09	6.3	.00591	1.09
20.0	4.0	.2	.000621	720.0	.00476	1.35	72.0	.00476	1.35	7.2	.00476	1.35
2.5	1.0	.4	.000621	90.0	.03385	.19	9.0	.03385	.19	.9	.03385	.19
3.7	1.5	.4	.000621	135.0	.02305	.28	13.5	.02305	.28	1.3	.02305	.28
5.0	2.0	.4	.000621	180.0	.01684	.38	18.0	.01684	.38	1.8	.01684	.38
6.3	2.5	.4	.000621	225.0	.01290	.50	22.5	.01290	.50	2.2	.01290	.50
7.5	3.0	.4	.000621	270.0	.01022	.63	27.0	.01022	.63	2.7	.01022	.63
8.8	3.5	.4	.000621	315.0	.00832	.77	31.5	.00832	.77	3.1	.00832	.77
10.0	4.0	.4	.000621	360.0	.00690	.93	36.0	.00690	.93	3.6	.00690	.93
1.2	1.0	.8	.000621	45.0	.02827	.23	4.5	.02827	.23	.5	.02827	.23
1.9	1.5	.8	.000621	67.5	.02138	.30	6.8	.02138	.30	.7	.02138	.30
2.5	2.0	.8	.000621	90.0	.01694	.38	9.0	.01694	.38	.9	.01694	.38
3.1	2.5	.8	.000621	112.5	.01382	.47	11.3	.01382	.47	1.1	.01382	.47
3.7	3.0	.8	.000621	135.0	.01153	.56	13.5	.01153	.56	1.3	.01153	.56
4.4	3.5	.8	.000621	157.5	.00979	.66	15.8	.00979	.66	1.6	.00979	.66
5.0	4.0	.8	.000621	180.0	.00842	.76	18.0	.00842	.76	1.8	.00842	.76

3-5 show the results for the summer months, with discharge rates Q = 500 gpm and Q = 1400 gpm, respectively. To interpret the results, it is fruitful to note the various items shown in each of the tables. The first column in Table 3-4 is the time after the initial release of the waste material. The second column converts the time into distance from the discharge point. In the third column, three different current speeds, namely 0.2 knots, 0.4 knots, and 0.8 knots are included. Based on Equation (3.1) the initial mean concentration, Co, is computed. For a discharge rate of 500 gpm Co is computed to be 0.000222. The vertical location of the centerline of the plume at different times for a fall velocity of 1 cm/sec is shown in the fifth column. The concentration at the centerline of the plume Cmax normalized with respect to Co is shown in column 6. The dilution, which can be obtained as the reciprocal of (Co) (Cmax/Co), can easily be obtained by the inverse of the value in column 4 multiplied by that in column 6. According to Soule and Oguri (1983) and Section III.A.2.C.1 of this report, the limiting permissible concentration (LPC) of the waste being discharged is 0.0004 % concentration of the fish waste. This value of concentration corresponds to a dilution of 250,000. Therefore, for convenience the dilution ratio has been normalized with respect to 250,000 and such ratio is presented in column 7. For the fall velocity of 0.1 cm/sec the corresponding results are presented in columns 8 to 10. Similarly the results for 0.01 cm/sec fall velocity are shown in columns 11 to 13. Thus, when one reads the value at columns 7, 10, and 13, a value of 1.00 implies the dilution of 250,000. A value greater than 1.0 implies a dilution greater than 250,000.

The major difference between the summer months and winter months is for the value of vertical diffusion. For the winter months, larger vertical diffusions were used causing more mixing and thus a larger dilution. It can be seen that a greater mixing, therefore larger dilution, is achieved in the winter months (Tables 3-6 and 3-7) in comparison with the corresponding results for that in the summer months (Tables 3-4 and 3-5).

The results presented in Tables 3-4 to 3-7 can be plotted to provide a better picture of the extent of the waste plume following a prescribed current direction. Based on the available data the two observed directions at the discharge site are SW and NW. The waste plume is therefore advected along these directions while experiencing a lateral mixing along the way.

3.3 Extent of the Plume at the Present Site

To show the extent of the plume, **at the present site,** curves containing a series of equi-dilution lines are presented in Figures 3-3 and 3-4 (based on the results presented in Tables 3-4 and 3-6 respectively). The dilution ratios shown are the dilutions normalized with respect to 250,000 (LPC) for both the summer and winter months and for current speeds of 0.2 knots, 0.4 knots, and 0.8 knots. The discharge rate for these figures is 500 gpm and the fall velocity is set at 0.01 cm/sec.

Figure 3-5 shows the equi-dilution lines in the summer months plotted on the map for a waste discharge of 500 gpm in a current of 0.2 knots towards the SW direction. Two different equi-dilution lines are drawn: the line for 0.5 represents a dilution of 125,000, while the line for 1.0 represents a dilution of 250,000. Such a favorable current direction would continue to carry the plume away in the SW direction. Thus, the plume would not reach the shore region while undergoing a significant mixing and diffusion.

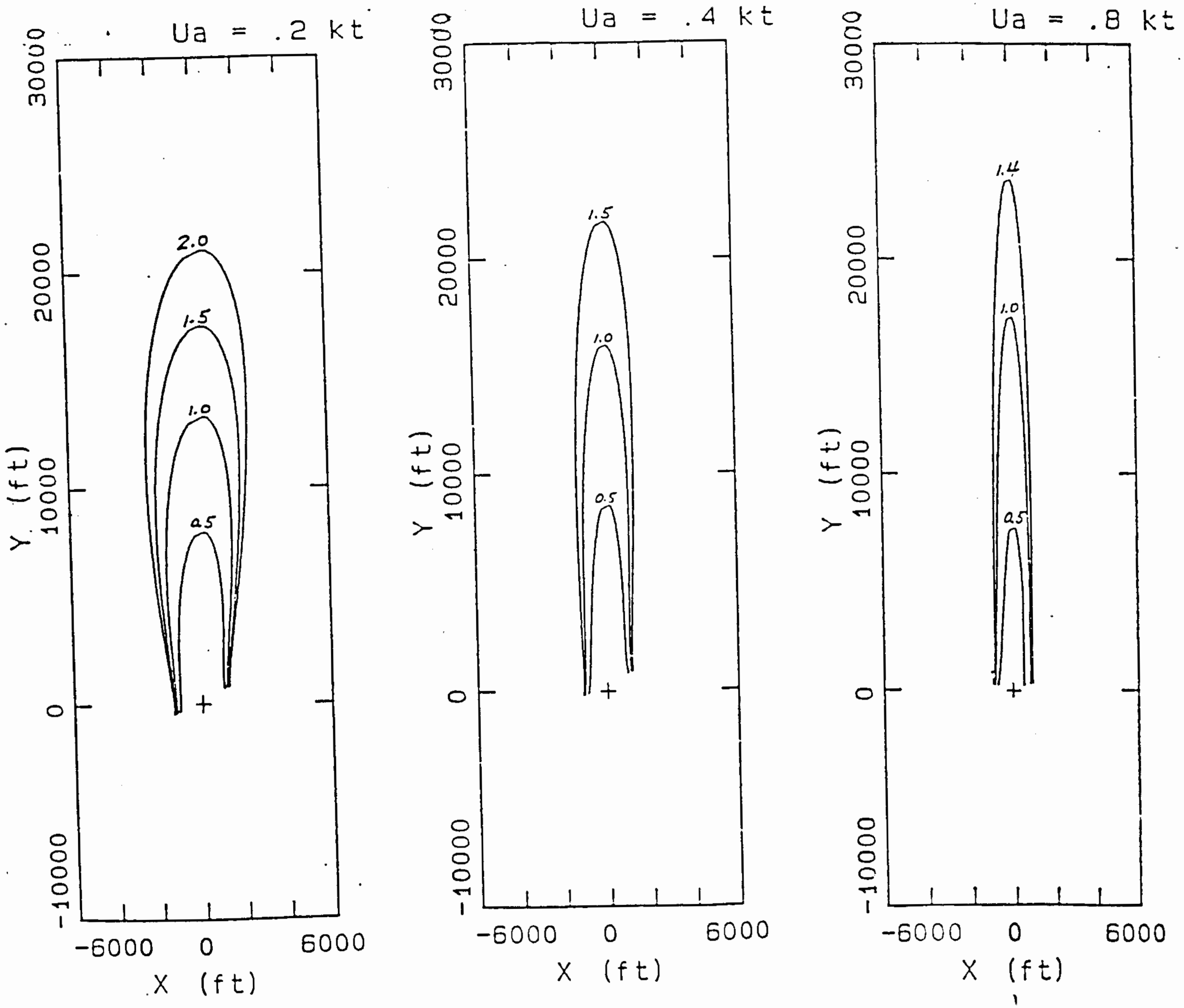

Figure 3-3. Equi-dilution lines of discharge waste plume, summer months. (Q = 500 gpm, Vfall = 0.01 cm/s, Ua = 0.2, 0.4, 0.8 kt).

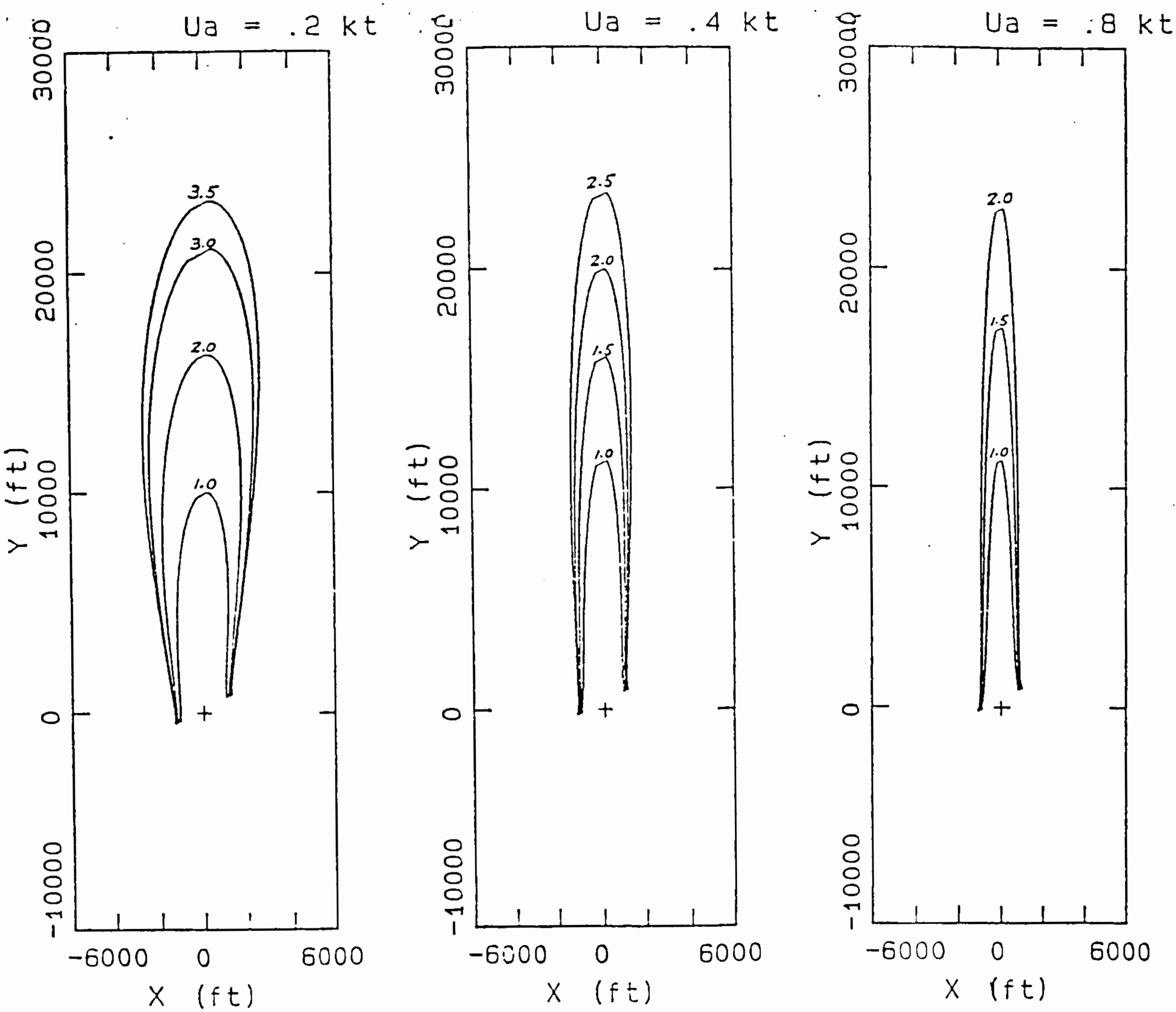

Figure 3-4. Equi-dilution lines of discharge waste plume, winter months. (Q = 500 gpm, Vfall = 0.01 cm/s, Ua = 0.2, 0.4, 0.8 kt).

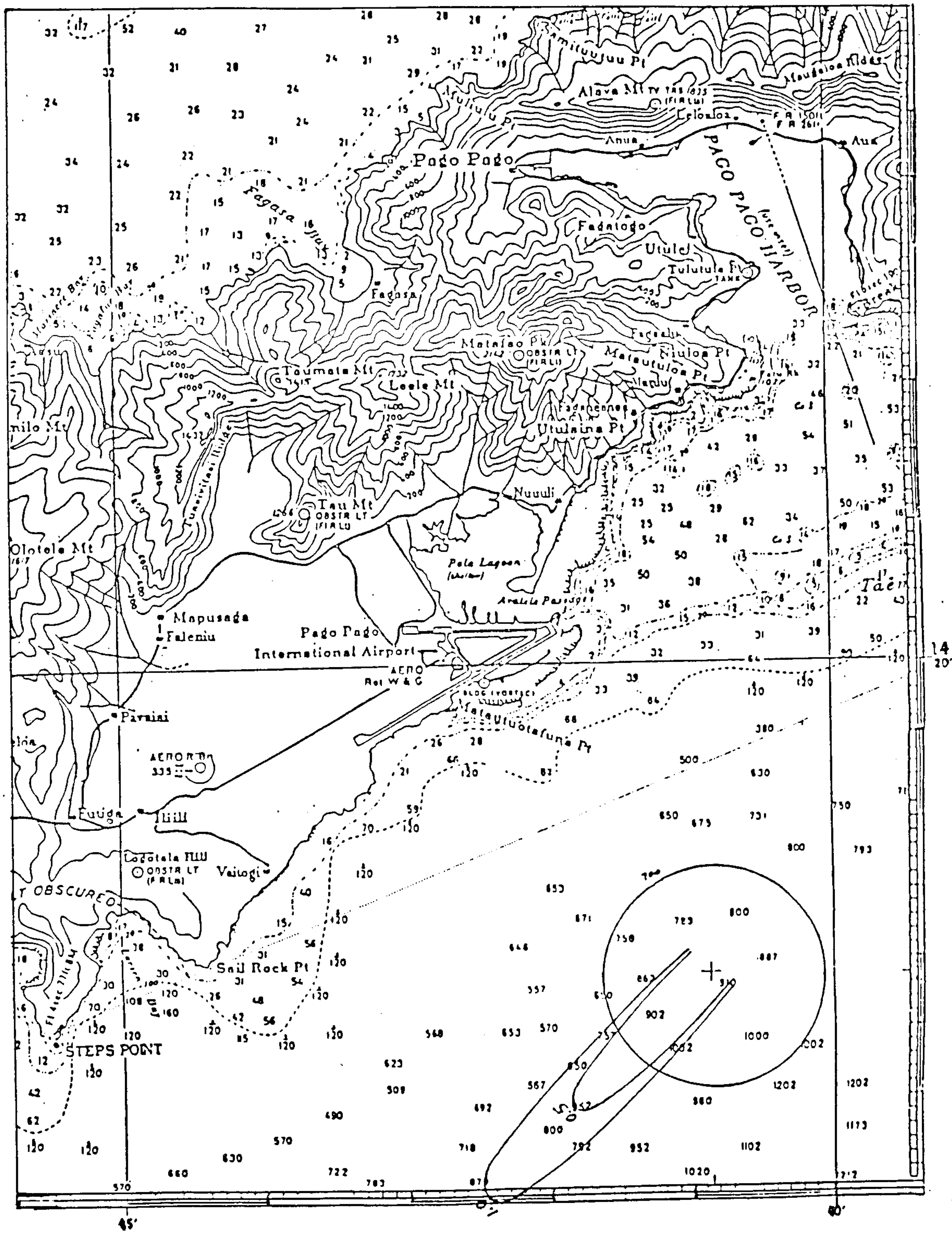

Figure 3-5. Equi-dilution lines of discharge waste plume, summer months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.2 kt).

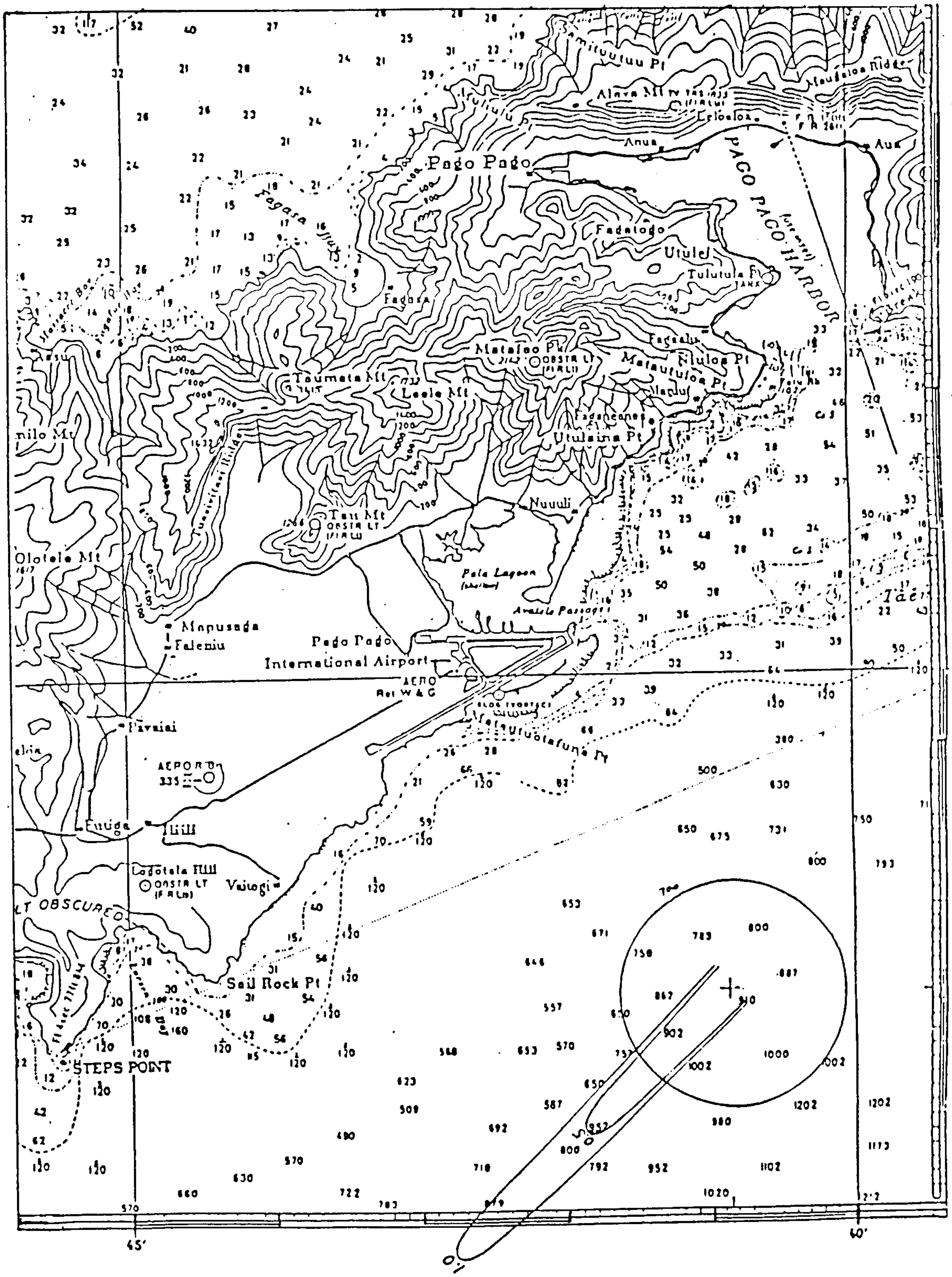

Figure 3-6. Equi-dilution lines of discharge waste plume, summer months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.4 kt).

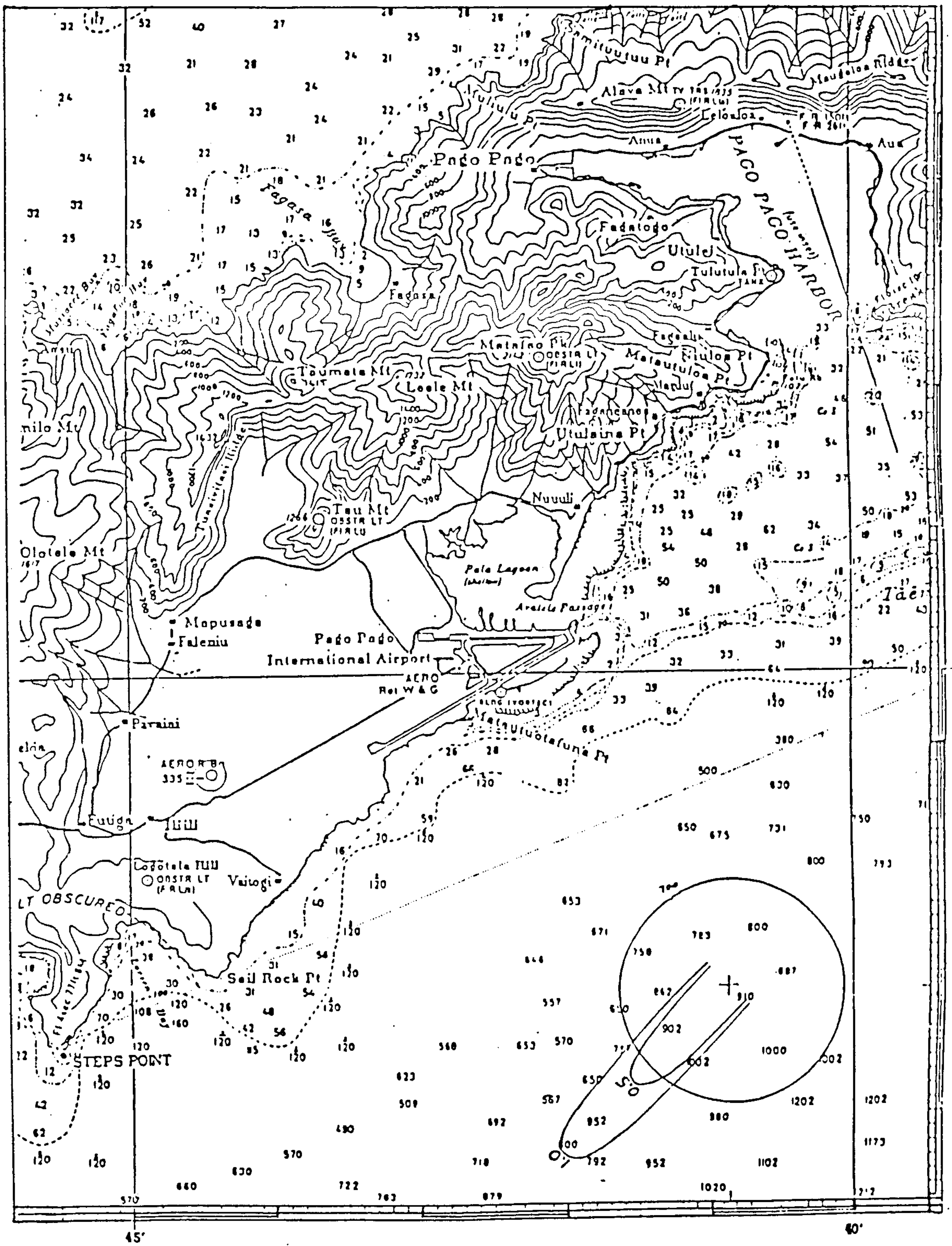

Figure 3-7. Equi-dilution lines of discharge waste plume, winter months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.2 kt).

Figure 3-6 shows the extent of the waste plume with a SW current of 0.4 kt. Comparing the results in Figure 3-6 with those in Figure 3-5, one observes that the effect of a stronger current is to advect the plume swiftly downstream in the current direction. Therefore, the extent of lateral diffusion is much narrower.

Figures 3-7 and 3-8 show the corresponding pictures for the winter months. By comparing these results with those presented in Figures 3-5 and 3-6, one can observe that a greater dilution is achieved in the winter months due to increased vertical diffusion.

The drogue studies conducted by Soule and Oguri (1984) indicate a current toward the southwest (SW) direction and that the data on the surface current presented in Figure III.8 also show predominant southwest surface current. However, some 1987 current meter data detect current in the northwest (NW) direction. Some current data indicated that a current in the southwest direction with a magnitude of 0.25 knots outside of the 120-fathom depth contour (CH2M Hill, 1976). A sketch confirming the direction of drogue movement (along the SW direction) after CH2M Hill is shown in Figure 3-9. Since the coastal current normally follows the depth contour, it is reasonable to expect a worst case illustration having a NW current (0.2 knots) at the dumpsite would at first carry the plume initially in the NW direction; however, as the plume propagates toward the shore the current will gradually bend the plume in a pattern such as shown in Figure 3-10. In fact, the simulated plume trajectory for this worst case scenario is illustrated in Figure 3-11. In Figure 3-11 the equi-dilution lines are drawn for the summer months with a waste discharge of 500 gpm in a current of 0.2 knots toward the NW direction at the dumpsite. It is seen that the dilution ratio of 1.0 (corresponds to 250,000

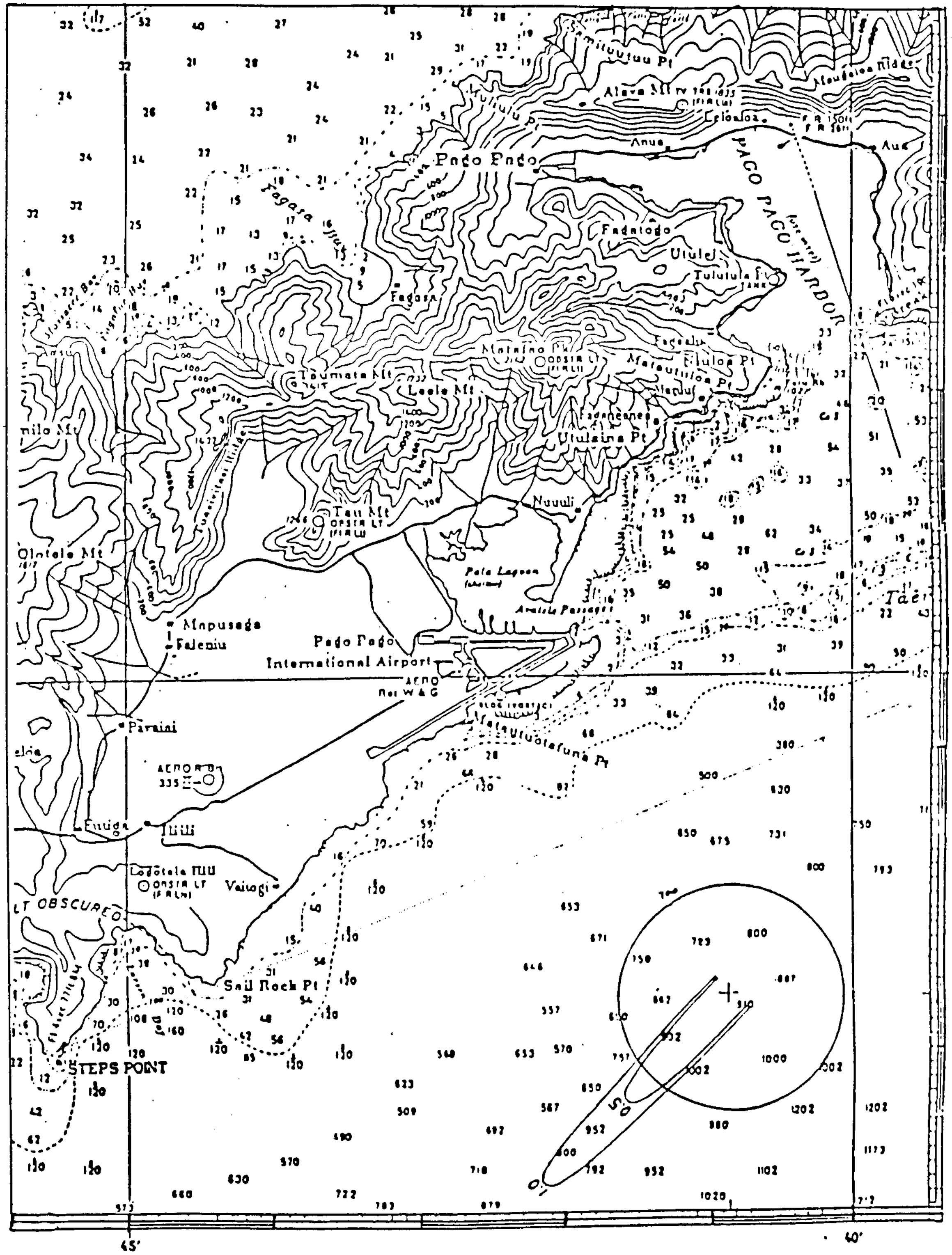

Figure 3-8. Equi-dilution lines of discharge waste plume, winter months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.4 kt).

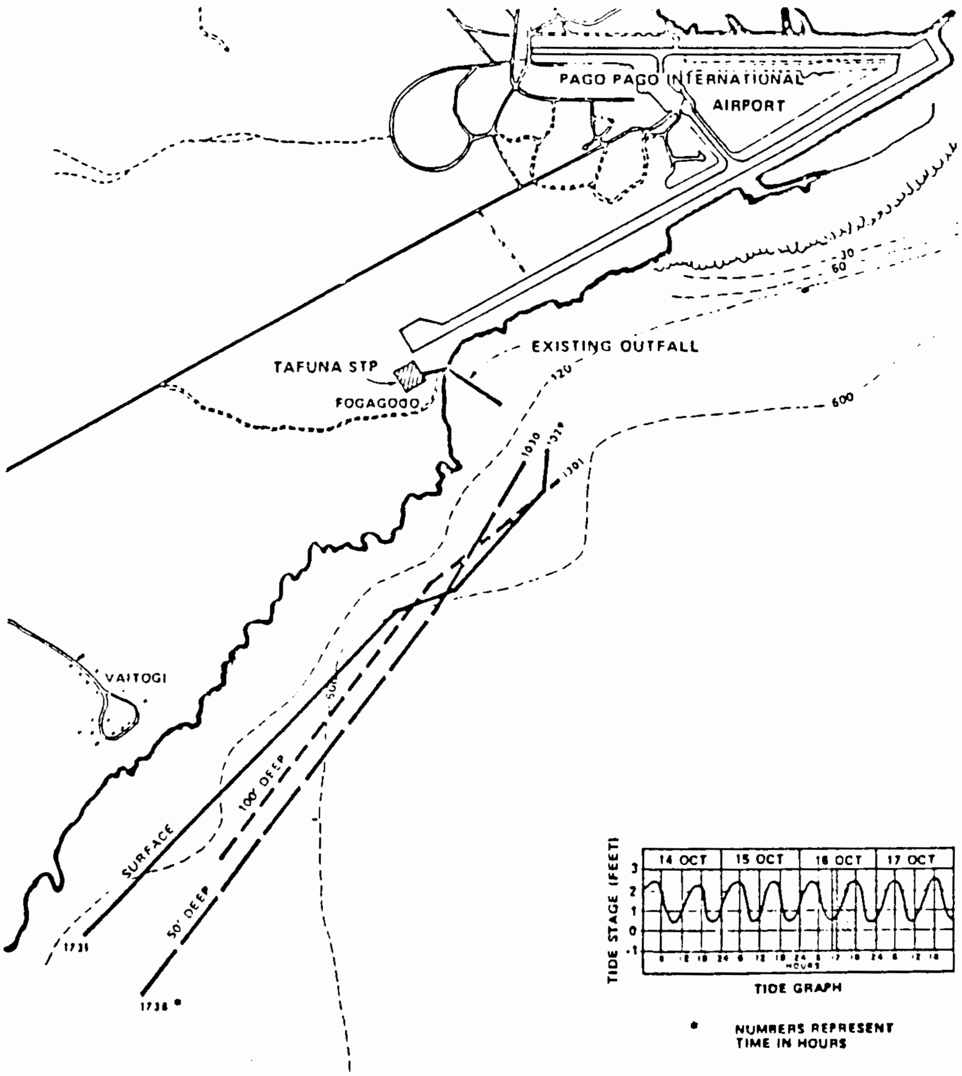

Figure 3-9. Drogue movement along shore (after CH2M Hill, 1976).

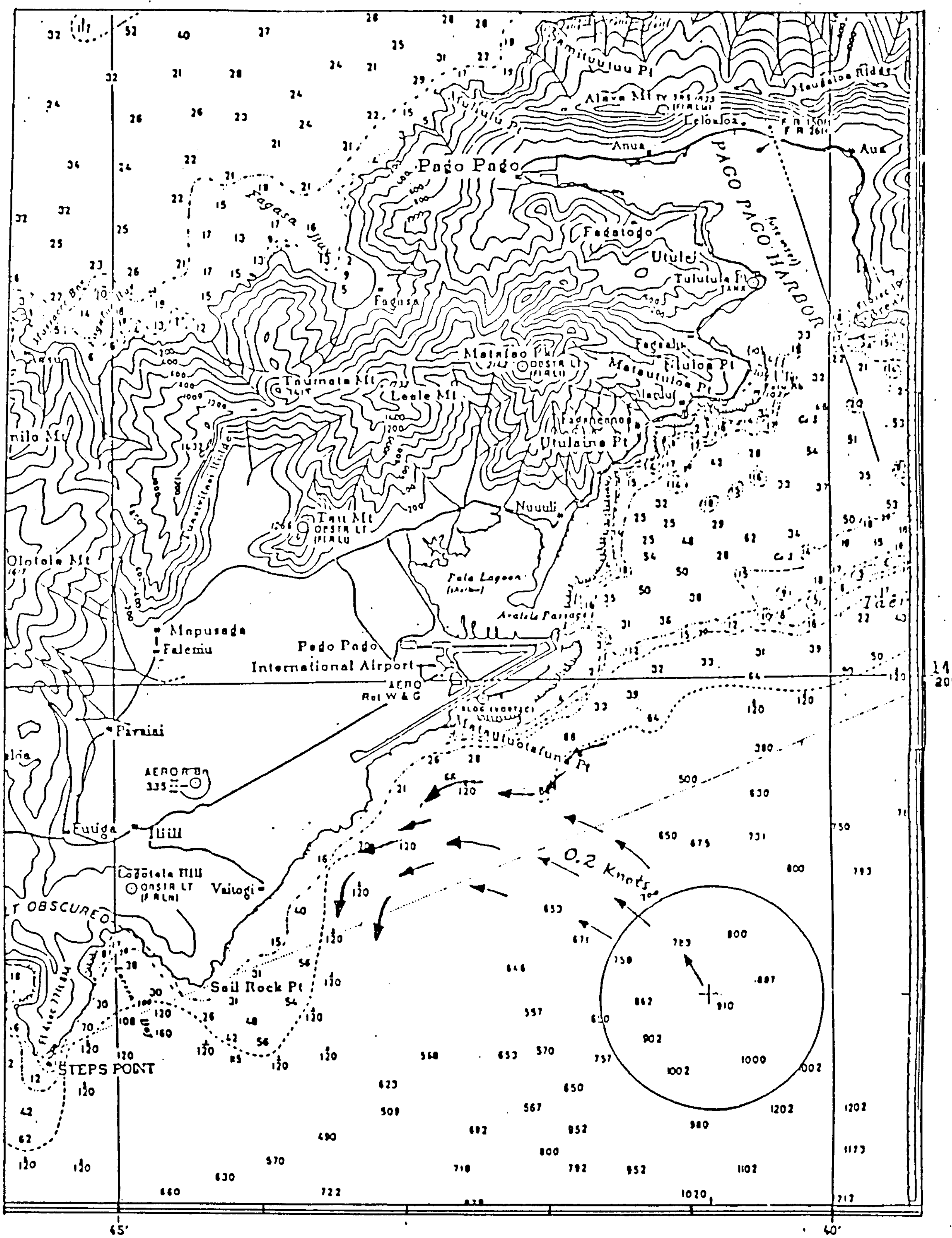

Figure 3.10. The expected near shore current pattern assuming the worst case scenario of NW current at the dumpsite.

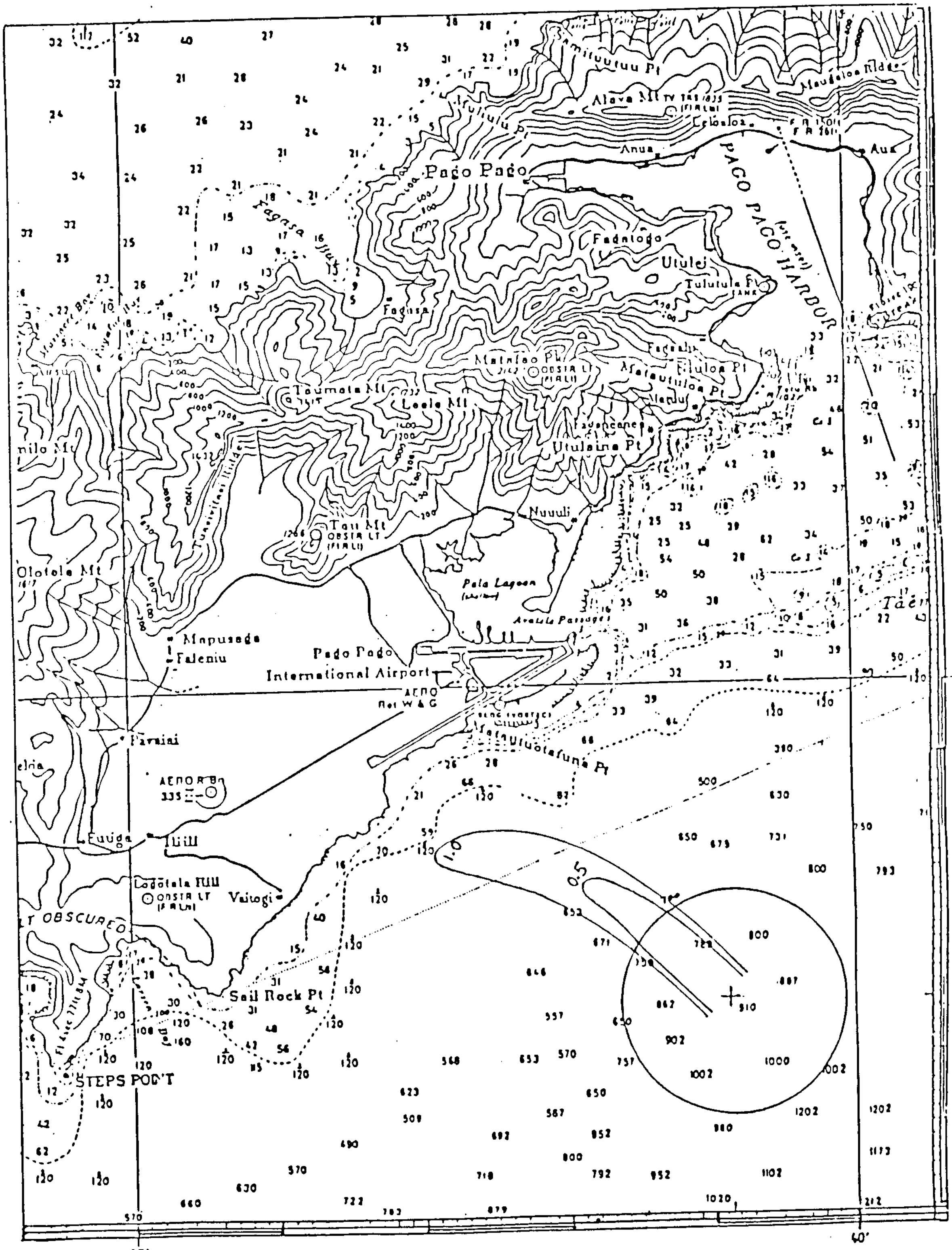

Figure 3-11. The worst-case illustration of the direction of the plume without the SW longshore current. the 250,000 dilution is reached before the plume reaches the 120 fm depth contour. Equi-dilution lones of discharge waste plume, summer months NW current (Q = 500 gpm, Vfall = 0.01 cm/s, Ua = 0.2 kt).

dilution) does not even reach a region at the 120-fathom contour, where significant change in water depth occurs. The longshore current in the SW direction would carry the plume in that direction, preventing the plume from reaching the shore region.

The longshore current to the SW is described in Section III.B.2.b. Therefore, the plume is expected to gradually bend toward the SW direction following the depth contour line (a direction along island shoreline) carrying the plume with it. In order to make a further, detailed prediction of the direction and the extent of the plume in this shallower water region, more definitive information on the seaward extent of the longshore current and its magnitude is needed. It should be emphasized that the results in Figure 3-9 are for the summer months. Results for the winter months would indicate more mixing, therefore greater dilution within the region shown.

3.4 Extent of Plume at Deeper Water Preferred Site.

With the selection of the deeper water site as the preferred site, the curves containing the equi-dilution lines were plotted for the same conditions shown in Figures 3-5 through 3-8 and 3-11 and discussed in Sectin 33. The results are shown in Figures 3-12 through 3-16.

Although the plumes are plotted from the center of the site, it has been recommended to EPA that the dump protocol be changed. The dump vessel would make observations of the surface current direction before dumping begins and dump at the upstream periphery, circling within the dumpsite during discharge. This would result in the plumes being dissipated to the LPC concentration of 1:250,000 within the dumpsite under most conditions.

The plume would not move inshore sufficiently to reach the longshore

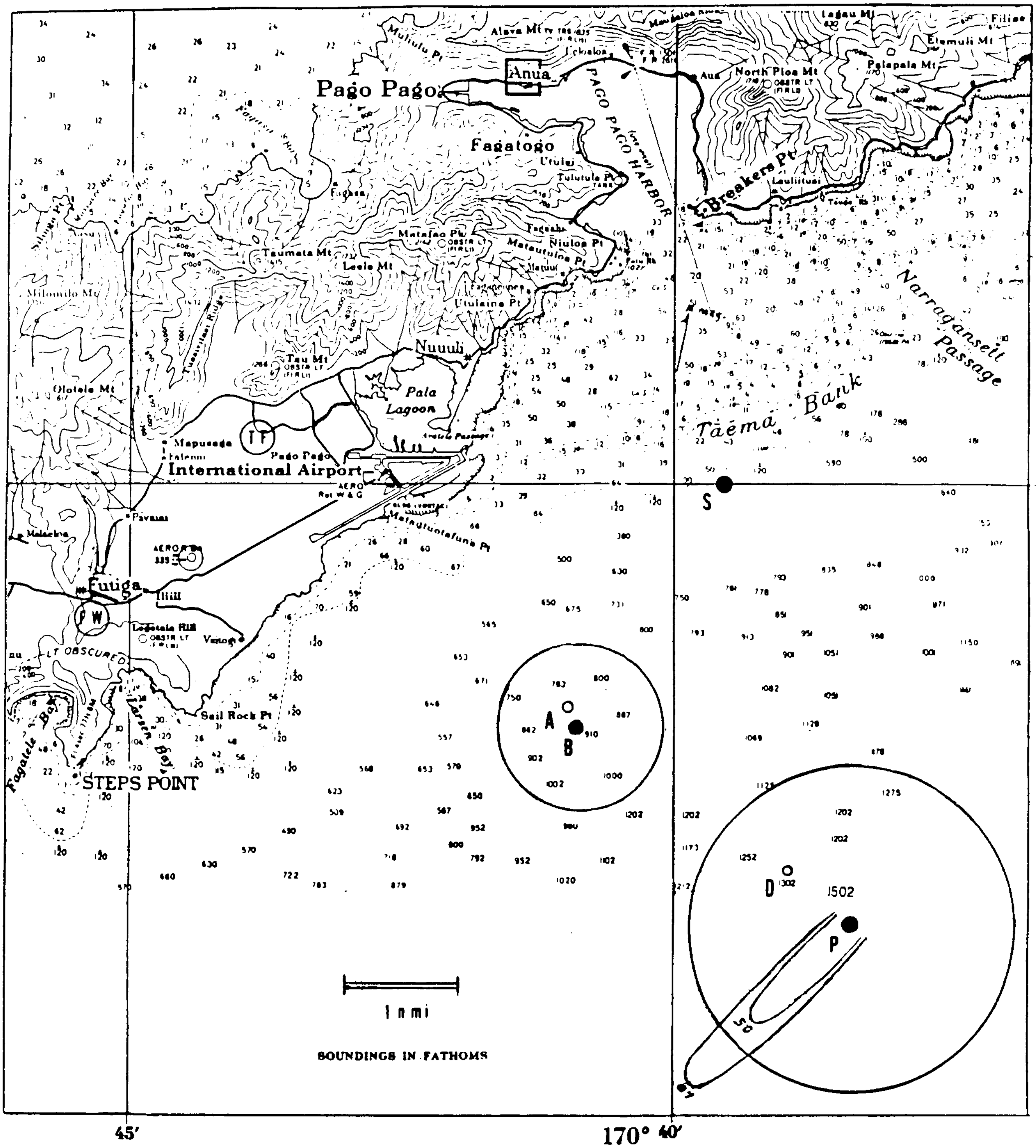

Figure 3-12. Equi-dilution lines of discharge waste plume, summer months SW current (Q= 500 gpm, Vfall = 0.01 cm/s Ua = 0.2 kt). If dumping were to take place at the NE periphery under these conditions, the plume would be fully dissipated, reaching background levels, within the dumpsite circle.

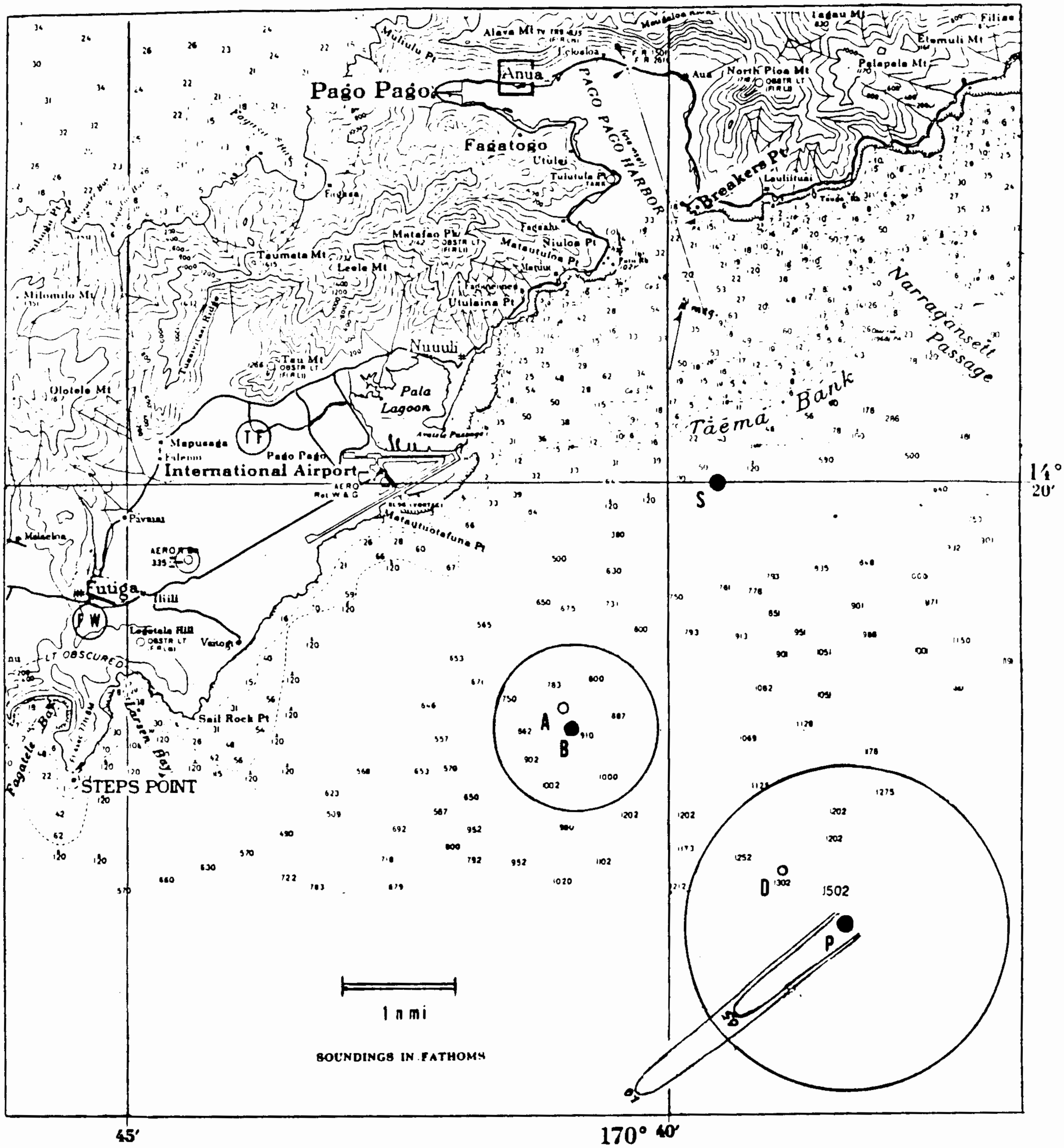

Figure 3-13. Equi-dilution lines of discharge waste plume, summer months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.4 kt). If dumping were to take place at the NE periphery under these conditions, the plume would be mostly dissipated within the dump circle.

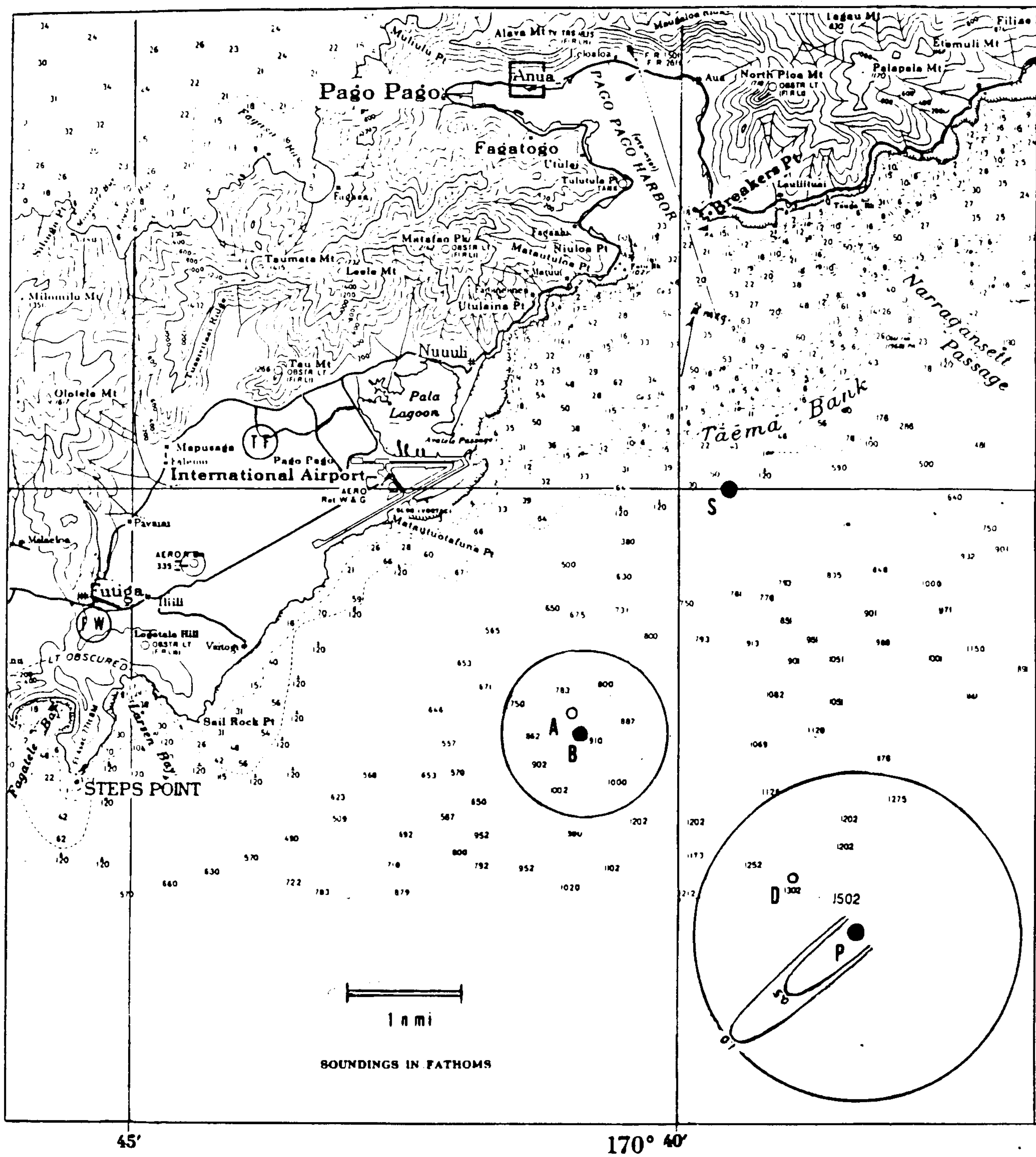

Figure 3-14. Equi-dilution lines of discharge waste plume, winter months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = 0.2 kt). If dumping were to take place at the NE periphery under these conditions, the plume would be dissipated within the dumpsite circle.

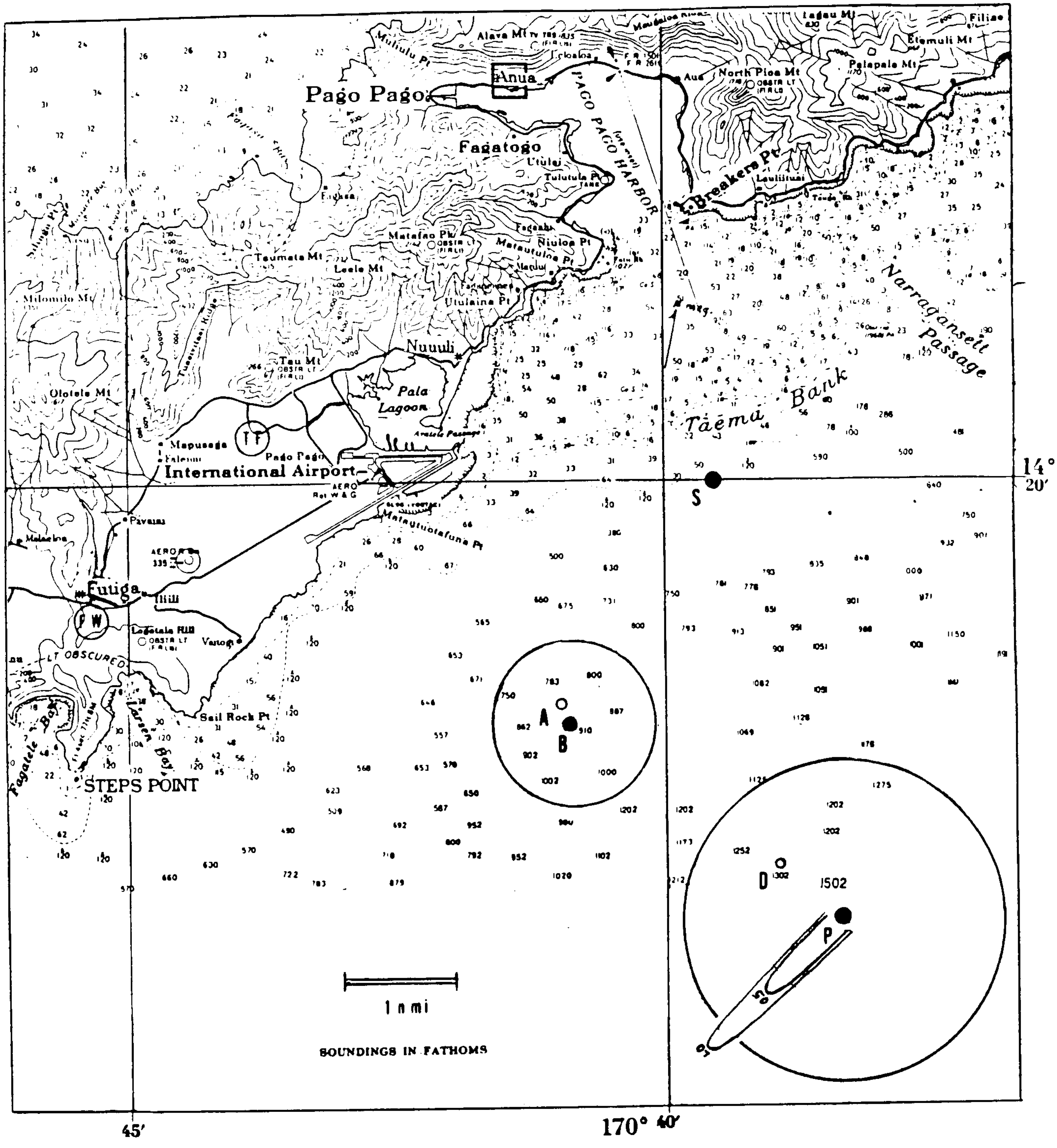

Figure 3-15. Equi-dilution lines of discharge waste plume, winter months SW current (Q = 500 gpm, Vfall = 0.01 cm/s Ua = o.4 kt). If dumping were to take place at the NE periphery under these conditions the plume would be dissipated within the dumpsite circle.

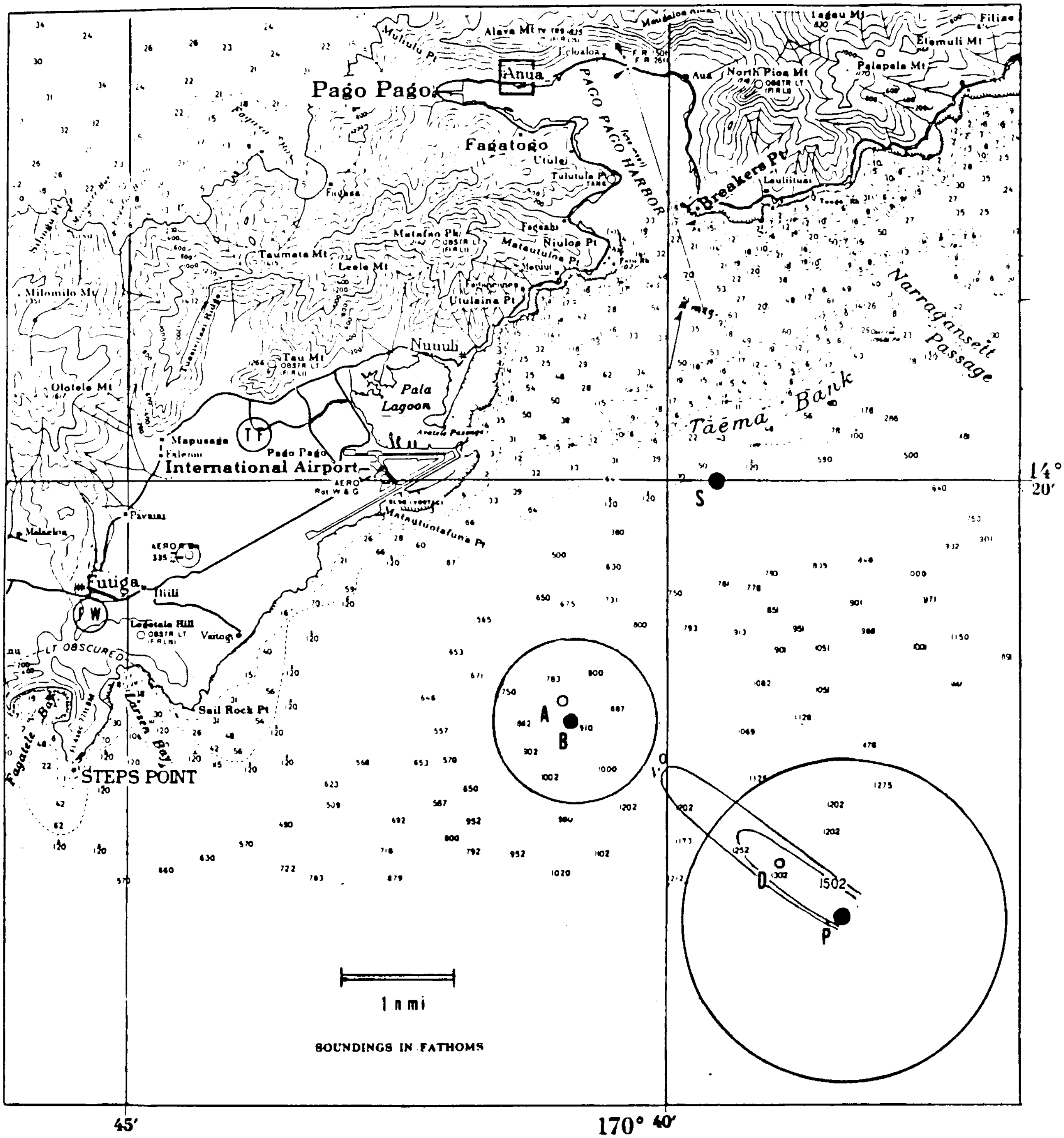

Figure 3-16. The worst-case illustration of the direction of the plume without the SW current. The 250, 000 dilution is reached before the plume reaches territorial waters. Equi-dilution lines of discharge waste plume, summer months NW current (Q = gpm, Vfall = 0.01 cm/s, Ua = 0.2 kt). If dumping were to begin at the SE periphery of the circle, the plume would be dissipated within the dumpsite circle.

current that generally flows southwest between the 120 fm and 600 fm contours. Even if a slick persisted on the surface it would generally be carried farther out to sea to the southwest and could not approach shallow waters.

4. CONCLUSION AND RECOMMENDATION

The results presented in this study are computed by a mathematical model of which the accuracy is dependent on the available data. Whenever the required data are not available, assumptions have been made for the parameters. We have used our best judgment in the estimation of the parameters. We believe that the results obtained by this mathematical model are at least as good as those obtained by any model using the present state of the knowledge.

The present mathematical model predicts the dilution as a function of distance and time from the point of release if the current direction is specified. The extent of the plume has also been shown under various conditions. A key factor in the determination of the plume trajectory is the direction of the ocean current. Field measurements indicate two persistent current directions, SW direction and NW direction. For current going towards the SW direction, it is shown that the plume at the present site will be advected in that direction at a distance at least 2 n mi south of Sail Rock Point. For current in the NW direction, significant dilution has been achieved when the plume reaches the region of shallower depth. Therefore, the longshore current is expected to carry such diluted plume again in SW direction (along the island shoreline direction). More definitive current, information especially on the incidence of reversal of the longshore current in the shallower depth region would be needed in order to predict the extent of the plume in the shallow depth region if the present site were to continue to be used.

By using the preferred deepwater site, and by dumping upstream the direction of flow, the plume would be fully dissipated within the dumpsite circle in most cases. The plume would not reach territorial waters, the longshore current, or the reefs.

If there is significant change in vessel size or in quantities dumped, the model should be run again to determine the nature of the plume trajectory and extent. A small change in vessel beam is not considered significant.

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Koh, R.C.Y. and Fan, L.N. 1970. "Mathematical Models for the Prediction of Temperature Distributions Resulting from the Discharge of Heated Water into Large Bodies of Water." Water Quality Office, Environmental Protection Agency. Report Number 16130DWO10/70. Also a Tetra Tech, Inc. Report. 219 pp.

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Soule, D.F. and Oguri, M. 1984. "Assessment of the Ocean Disposal Alter native for Management of Fish Processing Wastes." Final Report to NOAA - Grant # NA81RAD00009. Harbors Environmental Projects, Institute for Marine and Coastal Studies, University of Southern California.

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APPENDIX C

NEWS BULLETIN AND CORRESPONDENCE

ON CESSATION OF TERRESTRIAL DUMPING

PERMIT OD 88-02

NEWS BULLETIN

FRIDAY, SEPTEMBER 19, 1980

PUBLISHED BY THE OFFICE OF SAMOAN INFORMATION PAGO PAGO, AMERICAN SAMOA

OCEAN DUMPING PERMITS ISSUED TO CANNERIES

Longstanding efforts by the Government and canneries to find a solution for the disposal of wastes generated by the canneries now seem to have reached a welcome conclusion.

The United States Environmental Protection Agency in Region IX at San Francisco has advised the Governor's Office that, in response to requests from American Samoa, ocean dumping permits have now been issued to Starkist and Van Camp canneries.

Ocean dumping will drastically reduce the offensive odors emanating from the waste materials while being transported for dumping. More important, the problem of offensive odors for residents living near the present dumping sites will be finally resolved.

Although the ocean dumping permits have now been issued, no dumping may take place at the present time because designation of the ocean dumping site has not yet been made. The designation will be published very shortly as a proposed rule in the Federal Register, with a sixty-day comment period. A final determination will then be made upon completion of the review of all comments which have been submitted.

According to Mr. Pati Faiai, Executive Secretary for the Governor's Environmental Quality Commission, 'This is strictly a formality to comply with the federal laws but the issuance of the ocean dumping permits indicates that this longstanding problem which offended many of our citizens will be finally resolved in the near future."

Governor Coleman also expressed pleasure at this development. "I am pleased that this source of irritation for many of our people is finally being rectified," said the Governor, "and I wish to thank the canneries for their cooperation in helping to promote the general welfare of the public."

GOVERNOR PROCLAIMS CONSUMER EDUCATION WEEK

FONO IN ACTION

The following bills and resolutions have been introduced in the current regular session of the 16th Legislature:

HOUSE

HB No. 363, Roy J.D. Hall, Te'o J. Fuavai-- proposes a new Law of Acknowledgments as adopted and adapted from the statues of Hawaii.

HB No. 364, Roy J.D. Hall-- proposes to provide for new catagories for driver's license.

HB No. 365, Roy J.D. Hall-- proposes to provide for a more comprehensive service by publication statute than is currently on the books.

HCR No. 147, Jack Thompson, Fa'asuka S. Lutu-- requests the director of the Department of Agriculture to establish a livestock meal feed processing plant to be managed, regulated and controlled by his department.

HCR No. 148, Va'aitautia Talamoni-- requests the Director of Public Works to conduct a feasibility study for the construction of seawalls at the Village of Aua.

SENATE

SB No. 200, Gata E. Gurr-- proposes an act related to Forcible Entry and Detainer, Unlawful Detainer remedies for willful holding over and wrongful occupation.

SB No. 201, Gata E. Gurr-- proposes to define individually owned land and permits its alienation to certain persons, partnerships or corporations.

SCR No. 107, Mageo Atufili-- requests that the Department of Public Works construct a road between Happy Valley and Matafao.

SCR No. 108, Alo Steffany-- respectfully requests the Governor to direct the Department of Public Works to initiate renovation program for the improvement of the old reservoir at Matafao.

SCR No. 109, Galea'i Poumele-- this adjourns the 16th Fono, subject only to the Governor's call for a special session.

SCR No. 110, Mageo Atufili-- requests the Director of Public Works to reinforce the stream embankments of Pago stream.

SCR No. 111, Galea'i Poumele-- this complies with Federal FAA regulations regarding acceptance of air-

3/3/80 cc: R. E. Kelley
B. W. Leamy
E. A. Ryan (2)
[illegible]
J. E. Kirch
D. Ballands
E. Stockwell

GOVERNMENT OF AMERICAN SAMOA
PAGO PAGO, AMERICAN SAMOA 96799
TAX EXEMPTION BOARD

February 21, 1980

RECEIVED
MAR 4 1980
ENGINEERING DEPT.

RECEIVED
MAR 3 1980
OFFICE OF DAVID LAWSON

David S. Lawson
Assistant Treasurer
Star-Kist Foods, Inc.
Terminal Island, California 90731

Dear Mr. Lawson:

This is in reply to your letter of February 4, 1980, further concerning amendment of the present Star-Kist Samoa, Inc. tax exemption certificate as it pertains to the sludge pit problem.

In view of David P. Howecamp's letter of January 24, 1980, I am assuming at this point that prior to February 28, 1980, the canneries will ask the Director of Health for further delay in the termination and restoration dates consistent with the EPA ocean dumping permit issuance process. The Director has already indicated in her letter of January 13, 1980 to Dave Ballands of your company and Frank Hackmann of Ralston Purina Corporation, a copy of which is enclosed, that extensions, at least 30 days at a time, will be granted so long as the canneries are, in essence, seeking the permit in good faith. Since these extensions would be official government action when granted, it would not appear appropriate to me to consider at the same time Star-Kist Samoa, Inc. to be in any significant breach of the tax exemption agreement in this regard. Thus, I see no need to amend the certificate while there is real and officially sanctioned progress being made towards ocean dumping disposal.

On the other hand, if it appears that the canneries are deliberately delaying the change from land to ocean disposal, it would also seem equally inappropriate for the Government to in effect legitimate that delay by agreeing to amend the tax exemption certificate. The certificate afterall likewise contemplates continued good forth effort by Star-Kist Samoa, Inc. to solve this long-standing and offensive problem.

I would also note in passing that since I am chairman of both the Environmental Quality Commission, which is kept aware of the issues before the Director of Health, and the Tax Exemption Board, there should be no difficulty in coordinating the position of the Government in this matter from the viewpoint of both agencies.

Sincerely,

LYLE L. RICHMOND
Chairman

Encl.

AMERICAN SAMOA GOVERNMENT
PAGO PAGO, AMERICAN SAMOA 96799
OFFICE OF THE ATTORNEY GENERAL

In reply refer to:

Serial: 731-86

MAY 14, 1986

Gregory L. Deering
President/General Manager
Starkist Samoa Inc.
P.O. Box 368
Pago Pago, American Samoa 96799

Dear Mr. Deering:

The Attorney General has asked me to formally deny your request of May 1, 1986 to dispose of sediment from Starkist's waste water treatment surge tank at the Futiga Landfill. The government's position against land disposal of fish wastes at the Futiga Landfill or elsewhere remains firm.

Attached is a copy of the report prepared by agency representatives who, with your permission, were asked to investigate the nature of the sediment and problems associated with disposal. Their unanimous conclusion is that alternatives to land disposal are at this time readily available to the canneries. The government remains prepared to offer you all reasonable assistance in pursuing ocean disposal. We are prepared upon your request to immediately designate a site and disposal agreement for any and all wastes exempt from federal regulation under the Ocean Dumping Act.

I also bring to your attention the terms of clause 4 of the court order prohibiting the accumulation of fish wastes. From your own indications, unless Starkist takes immediate action the conditions of the court order will be violated.

I urge your immediate response.

~~Sincerely,~~

PHYLLIS A. COVEN
Assistant Attorney General

AMERICAN SAMOA GOVERNMENT

OFFICE OF THE ATTORNEY GENERAL

In reply refer

Serial: 732-86

May 14, 1986

Robert W. Lemke
General Manager
Samoa Packing Company
P.O. Box 957
Pago Pago, American Samoa 96799

Dear Mr. Lemke:

Thank you for your participation in last week's meeting on the ocean-dumping disposal alternative. I am enclosing for your information a copy of a preliminary report prepared by agency representatives on the issue of vessel and site availability. Ocean disposal appears as a viable alternative for accomodating the canneries' disposal requirements. The government's position on land disposal remains firm, and we stand immediately prepared to designate on ocean dump site and agreement for its use for all fish waste exempt from the Federal Ocean Dumping Act.

Sincerely,

PHYLLIS A. COVEN
Assistant Attorney General

PAC:fst

Encl.

Star-Kist SAMOA, Inc.

P.O. Box 368 · Pago Pago · Tutuila Island · American Samoa

OFFICE OF THE GENERAL MANAGER

January 7, 1981

Mr. Lyle Richmond
Chairman
Environmental Control Commission
Office of the Governor
American Samoa Government
Utulei, American Samoa 96799

Dear Mr. Richmond:

In your letter of December 3 granting the canneries extended use of the Tafuna sludge pits through December 31, 1980, You asked that we provide you with the written statement anticipating initiation of the ocean dumping system.

In the initial stages of the ocean dumping operation, Star-Kist worked very close verbally with both Pati Fai'ai and Mary Busby of the E. Q. C. It was their verbal request that they be contacted prior to each of the initial trips and this has been done. Ocean dumping by Star-Kist began December 16th. As of the same date use of the Tafuna sludge pit by Star-Kist was suspended.

As we now begin operations for 1981, we continue to use ocean dumping as our sole method for sludge disposal.

Sincerely,

STAR-KIST SAMOA, INC.

L. A. KROGSDALE
General Manager

/tsl

xc to: Governor
Lt. Governor
Attorney General
Commanding Officer, U.S. Coast Station, Pago

RECEIVED
JAN 9 1981
ENGINEERING DEPT.

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1980
ENGINEERING DEPT.
12/11/80

OFFICE OF THE GOVERNOR

ENVIRONMENTAL QUALITY COMMISSION

Serial:

December 3, 1980

L. A. Krogsdale
General Manager
Star-Kist Samoa, Inc.
Pago Pago, American Samoa

William Perez
General Manager
Van Camp Seafood Company
Pago Pago, American Samoa

FROM THE DESK OF
L. A. KROGSDALE

Gentlemen:

The requests of Van Camp Seafood Company and Star-Kist Samoa, Inc., dated November 25 and 29, 1980 respectively, to extend use of the sludge disposal pit at Tafuna until December 31, 1980 are granted.

It must be reiterated, however, that, as you know, the month-to-month extensions, beginning with March, 1980, have been predicated on the continued good faith efforts by the canneries to obtain a permit from the U.S. Environmental Protection Agency for ocean dumping as the most currently feasible alternative to land disposal. As you also know, the ocean site designation on November 24, 1980 was the final step in the ocean dumping permit process.

Now, however, we are informed that the U.S. Coast Guard, which is the federal authority for local administration of the permit, including oversight of the condition of the vessel used to haul the sludge to the ocean dumping site, has found the condition of the vessel selected to be unacceptable. This tends to contradict the verbal representations of the canneries over the past several months that they were prepared to commence ocean disposal whenever the permit was granted. According to the Commanding Officer of the local Coast Guard unit, the deficiencies of the vessel in question have been known by the canneries and the vessel owner for at least four weeks.

Meanwhile, the level of nitrates in the drinking water supplied from the well fields near the Tafuna land disposal site has increased materially over the past year. The level is still well below the level considered dangerous to human health, but continued increase must be brought under control well before it approaches that point. Ongoing concern for the unpleasant odors emanating from this site should need little reminder.

The Environmental Quality Commission looks to the canneries to take a leading role in resolving the current situation. Accordingly, any further extensions of the present land disposal system will be based on a positive showing to our satisfaction that the canneries are dealing constructively with this situation and any other problems that may arise.

We expect to receive a written statement from you no later than December 17, 1980 indicating when it is anticipated that the ocean dumping system will be operational and the steps taken and to be taken to accomplish this objective.

Sincerely,

LYLE L. RICHMOND
Chairman

cc: Governor
Lt. Governor
Attorney General
Commanding Officer, U.S. Coast Guard Station

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

04 MAR 1988

In Reply
Refer To: W-7-1

Jefferey R. Naumann
Manager, Environmental Engineering
Star-Kist Foods, Inc.
180 East Ocean Boulevard
Long Beach, California 90802

Re: Issuance of Ocean Dumping Permit OD 88-01

Dear Mr. Naumann:

After careful consideration of the comments received by EPA, we have revised the draft research permit for ocean disposal of fish cannery wastes generated at the two fish canning plants in American Samoa.

In your review of the enclosed "comment and response" document, you will note that many of your suggestions, as well as those of the American Samoa Government have been incorporated in the final permit. Should you have any questions regarding Ocean Dumping Permit OD 88-01 (enclosed), please contact Patrick Cotter at (415) 974-0257.

Thank you for your prompt comments on the draft permit.

Sincerely,

Harry Seraydarian

Harry Seraydarian
Director
Water Management Division

Enclosures

cc: Fred [illegible], Van Camp Seafood
Albert Cropley, Star-Kist Samoa
Manley Sarnowski, Samoa Packing

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

04 MAR 1988

In Reply
Refer To: W-7-1

SUBJECT: Issuance of a Final Research Ocean Dumping Permit for Disposal of Cannery Wastes from Fish Processing Plants in American Samoa

Dear Interested Party:

The U.S. Environmental Protection Agency (EPA), Region 9 has issued a research permit, No. OD 88-01, to Star-Kist Samoa, Inc. and Samoa Packing Company. The permit has been issued under Section 102 of the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972 (33 USC 1401 et seq.). The permittees are authorized to dispose of cannery wastes, produced at fish processing plants in Pago Pago, at an ocean disposal site approximately 2.35 nautical miles off American Samoa. EPA's responses to public comments are enclosed with the permit.

The MPRSA research permit was effective on March 4, 1988. If you have any questions on the permit, please contact Patrick Cotter at (415) 974-0257 or Susan Cox at (415) 974-7432.

Sincerely,

Janet Y. Hashimoto

Janet Hashimoto
Chief
Oceans and Estuaries Section

Enclosures

MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT
OCEAN DUMPING PERMIT

PERMIT NUMBER AND TYPE: OD 88-02 Research

EFFECTIVE DATE: September 12, 1988

EXPIRATION DATE: March 12, 1989

REAPPLICATION DATE: December 6, 1988

APPLICANTS:	Star-Kist Samoa, Inc. P.O. Box 368 Pago Pago American Samoa 96799	Samoa Packing Co., Inc. P.O. Box 957 Pago Pago American Samoa 96799
PERMITTEES:	Star-Kist Samoa, Inc. P.O. Box 368 Pago Pago American Samoa 96799	Samoa Packing Co., Inc. P.O. Box 957 Pago Pago American Samoa 96799
WASTE GENERATORS:	Star-Kist Samoa, Inc. P.O. Box 368 Pago Pago American Samoa 96799	Samoa Packing Co., Inc. P.O. Box 957 Pago Pago American Samoa 96799

WASTE TRANSPORTER: Silk and Boyd
MV Mataora
Pago Pago, American Samoa

PORT OF DEPARTURE: Pago Pago Harbor, American Samoa

This Research Permit authorizes the transportation and dumping into ocean waters of certain material as described in the Special conditions section pursuant to the Marine Protection, Research, and Sanctuaries Act of 1972 (33 U.S.C. 1401 et seq.), as amended, (hereinafter referred to as "the Act"), regulations promulgated thereunder, and the terms and conditions set forth below.

A research permit is being issued to determine whether dumping of a substance will unreasonably degrade or endanger human health, welfare or amenities, or the marine environment, ecological systems, or economic potentialities [33 U.S.C. 1412a(1)(B)]. The Environmental Protection Agency (EPA) has determined that the scientific merit of the proposed project outweighs the potential environmental risks or other damage that may result from the dumping [40 CFR 220.3(e)].

1. GENERAL CONDITIONS

1.1. Operation under this Ocean Dumping permit shall conform to all applicable Federal statutes and regulations including, but not limited to, the Act, the Clean Water Act (33 U.S.C. 1251 et seq.) and the Ports and Waterways Safety Act (33 U.S.C. 1221 et seq.)

1.2. All transportation and dumping authorized herein shall be undertaken in a manner consistent with the terms and conditions of this permit. The permittees designated above shall be liable for compliance with all such terms and conditions. The liability of the permittees is set forth in the Special Conditions and they are jointly responsible for compliance with the terms of this permit. The permittees shall be held jointly and severally liable under Section 105 of the Act (33 U.S.C. 1415) in the event of any violation of the permit.

1.3. Under Section 105 of the Act any person who violates any provision of the Act, 40 CFR 220 through 229 issued thereunder, or any term or condition of this permit shall be liable for a civil penalty of not more than $50,000 per day for each violation. Additionally, any knowing violation of the Act, 40 CFR 220 through 229 or the permit may result in a criminal action being brought with penalties of not more than $50,000 or one year in prison, or both. Violations of the Act or the terms and conditions of this permit include but are not limited to:

1.3.1. Transportation to, and dumping at any location other than that authorized by this permit;

1.3.2. Transportation and dumping of any material not identified in, more frequently than, or in excess of that identified in this permit, unless specifically authorized by a written modification hereto;

1.3.3. Failure to conduct permit monitoring as required in Special Conditions 3.1, 4.6 and 5.1; or

1.3.4. Failure to file waste stream and disposal site monitoring reports as required in Special Conditions 3.3, 4.6, 5.2 and 5.3.

1.4. Nothing contained herein shall be deemed to authorize, in any way, the transportation from the United States for the purpose of dumping into the ocean waters, into the territorial sea, or into the contiguous zone, the following material:

1.4.1. Radioactive wastes;

1.4.2. Materials, in whatever form, produced for radiological, chemical, or biological warfare; or

1.4.3. Persistent synthetic or natural materials which may float or remain in suspension in the ocean.

1.5. Nothing contained herein shall be deemed to authorize, in any way, violation of applicable American Samoa Water Quality Standards.

1.6. After notice and opportunity for a hearing, this permit shall be subject to revision, revocation or limitation, in whole or in part, subject only to the provisions of 40 CFR 222.3(b) through (h) and 40 CFR 223.2, as a result of a determination by the Regional Administrator of EPA that:

1.6.1. The cumulative impact of the permittees' dumping activities or the aggregate impact of all dumping activities in the dump site designated in Special Condition 2.2 should be categorized as Impact Category I, as defined in 40 CFR 228.10(c)(1);

1.6.2. There has been a change in circumstances relating to the management of the disposal site designated in Special Condition 2.2;

1.6.3. The dumping authorized by the permit would violate applicable American Samoa Water Quality Standards; or

1.6.4. The dumping authorized can no longer be carried out consistent with the criteria set forth in 40 CFR 227 and 228.

1.7. The permittees shall ensure at all times that facilities, including vessels, are in good working order and operate as efficiently as possible to achieve compliance with the terms and conditions of this permit. During all transportation and loading operations, there shall not be a loss of material to any waterway.

1.8. The permittees shall allow the Regional Administrator of EPA, the Commander of the Fourteenth U.S. Coast Guard District (USCG), the Executive Secretary of the American Samoa Environmental Quality Commission (EQC), and/or their authorized representatives:

1.8.1. To enter into, upon, or through the permittees' premises, vessels, or other premises or vessels under the control of the permittee, where, or in which, a source of material to be dumped is located or in which any records are required to be kept under the terms and conditions of this permit or the Act;

1.8.2. To have access to and copy any records required to be kept under the terms and conditions of this permit or the Act;

1.8.3. To inspect any dumping equipment, navigational equipment, monitoring equipment or monitoring methods required in this permit;

1.8.4. To sample or require that a sample be drawn, under EPA, USCG, or EQC supervision, of any materials discharged or to be discharged; and

1.8.5. To inspect laboratory facilities, data, and quality control records required for compliance with any condition of this permit.

1.9. If material which is regulated by this permit is disposed of, due to an emergency to safeguard life at sea in locations or in a manner not in accordance with the terms of this permit, the permittees shall make a full report, in accordance with the provisions of 18 U.S.C. 1001, within 15 days to the EPA Regional Administrator, the USCG and the EQC or their delegates detailing the conditions of this emergency and the actions taken, including the nature and amount of material disposed.

1.10. The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of rights, nor any infringement of Federal, State or local laws or regulations, nor does it obviate the necessity of obtaining State or local assent required by applicable law for the activity authorized.

1.11. This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities, or, except as authorized by this permit, the undertaking of any work in any navigable waters.

1.12. Unless otherwise provided for herein, all terms used in this permit shall have the meanings assigned to them by the Act or 40 CFR 220 through 229, issued thereunder.

2. SPECIAL CONDITIONS - PERMIT LIMITATIONS

Permit limitations are required to define the length of the permit period, identify the dump site location, describe the waste materials and define maximum permitted limits for each waste material.

2.1. Location of Waste Generator and Permit Term

2.1.1. The material to be dumped shall consist of waste materials resulting from the operation of the permittees' fish canneries at Pago Pago Harbor, American Samoa.

2.1.2. This permit shall expire at midnight on February 6, 1989.

2.2. Location of Disposal Site

Transportation for the purpose of ocean dumping shall terminate at, and waste disposal shall be confined to a circular area with 1.5 nautical mile diameter centered at 14^{O} 22' 11" South latitude by 170^{O} 40' 52" West longitude.

2.3. Description of Material

2.3.1. During the term of this permit, and in accordance with all other terms and conditions of this permit, the permittees are authorized to transport for disposal into ocean waters quantities of waste material that shall not exceed the following amounts:

2.3.1.1. Star-Kist Samoa

Waste Material	Amount
Dissolved Air Flotation (DAF) Sludge	60,000 gallons/day
Precooker Water	100,000 gallons/day
Press Water	40,000 gallons/day
Total Maximum Daily Volume	200,000 gallons/day

2.3.1.2. Samoa Packing Company

Waste Material	Amount
Dissolved Air Flotation (DAF) Sludge	31,400 gallons/day
Precooker Water	13,300 gallons/day
Press Water	12,200 gallons/day
Total Maximum Daily Volume	56,900 gallons/day

2.3.1.3. Total Permitted Waste Material Discharges

Waste Material	Amount
Dissolved Air Flotation (DAF) Sludge	91,400 gallons/day
Precooker Water	113,300 gallons/day
Press Water	52,200 gallons/day
Total Maximum Daily Volume	256,900 gallons/day

2.3.2. The transportation for disposal of flotables, garbage, domestic trash, waste chemicals, and solid waste is prohibited.

2.4. Waste Material Limitations

2.4.1. Permitted Physical and Chemical Constituents

Fish Processing Waste Material	Total Permitted Daily Volume To Be Dumped	Permitted Maximum Concentration Per Constituent	
DAF Sludge[a]	91,400 gal/day	Tot. Sus. Solids	219,000 mg/L
		BOD_5	337,500 mg/L
		Total Phosphorus	3,390 mg/L
		Total Nitrogen	15,000 mg/L
		Oil and Grease	151,000 mg/L
Precooker Water	113,300 gal/day	Tot. Sus. Solids	102,000 mg/L
		BOD_5	82,100 mg/L
		Total Phosphorus	1,295 mg/L
		Total Nitrogen	9,930 mg/L
Press Water	52,200 gal/day	Tot. Sus. Solids	441,000 mg/L
		BOD_5	213,000 mg/L
		Total Phosphorus	11,360 mg/L
		Total Nitrogen	22,000 mg/L

a = Concentrations listed for each of the waste materials are based on historical information and data provided by the applicants.

2.4.2. The pH range for all waste materials shall not be less than 5.5 pH units nor greater than 7.0 pH units.

2.4.3. The Permitted Maximum Concentration and pH limits, listed above, shall not be exceeded at any time during the term of this permit.

3. SPECIAL CONDITIONS - ANALYSIS OF WASTE MATERIAL

Compliance with the permitted maximum concentrations defined in Special Condition 2.4 shall be determined by monthly monitoring of each of the waste streams permitted for ocean disposal before the material is loaded into the disposal vessel. Analysis of these waste streams (including DAF sludge, press water and precooker water) is required because these materials have been identified by the permittees for disposal.

Additional analyses of fish processing wastes and reporting requirements are defined in this section. Sampling dates shall be scheduled within the first two weeks of the month to allow enough time for laboratory analysis and report writing in compliance with Special Condition 3.3.

3.1. Analyses of Waste Material

3.1.1. Concentrations of the constituents in Special Condition 2.4 shall be determined by pooling three replicate samples, taken on the day that sampling is scheduled, to be used as a composite sample.

3.1.2. In addition to Special Condition 3.1.1, the permittees shall measure the following parameters by pooling three replicate samples from each waste material to obtain a composite sample:

Parameter	Detection Limits
Bulk Density	0 01 g/mL
pH	0.1 pH units
Total Solids	10 mg/L
Total Volatile Solids	10 mg/L
BOD_5	10 mg/L
Total Phosphorus	1 mg/L
Total Nitrogen	1 mg/L
Ammonia	1 mg/L
Oil and Grease	5 mg/L
Aluminum	0.1 mg/L
Chromium	0.1 mg/L
Nickel	0.1 mg/L
Copper	0.1 mg/L
Lead	0.1 mg/L
Cadmium	0.1 mg/L
Mercury	0.01 mg/L
Total Petroleum Hydrocarbons[a]	50 ug/L

a = Measured by infrared spectrophotometry (i.e., EPA Method 418.1)

3.1.3. All waste material sampling procedures, analytical protocols, and quality control/quality assurance procedures shall be performed in accordance with guidelines specified by EPA Region 9. The following references shall be used by the permittees where appropriate:

3.1.3.1. 40 CFR 136, EPA Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act;

3.1.3.2. Tetra Tech, Inc. 1985. Summary of U.S.. EPA-approved methods, standard methods and other guidance for 301(h) monitoring variables. Final program document prepared for the Marine Operations Division, Office of Marine and Estuarine Protection, U.S. Environmental Protection Agency. EPA Contract No. 68-01-693. Tetra Tech, Inc., Bellevue, Wa. 18pp.; and

3.1.3.3. Environmental Protection Agency. 1987. Quality assurance and quality control for 301(h) monitoring programs: Guidance on field and Laboratory Methods. Office of Marine and Estuarine Protection, Washington, D.C. EPA 430/9-86-004.

3.1.4. Any waste material constituents listed in Special Condition 3.1.2 that are shown to be consistently nondetectable after the first three sampling periods, may be eliminated from further analytical tests. Before elimination of the parameter is permitted, the permittee shall obtain written approval from EPA Region 9 and the EQC.

3.2. <u>Analytical Laboratory</u>

3.2.1. Within 30 days of the effective date of this permit, the name and address of the designated laboratory or laboratories and a description of all analytical test procedures and quality assurance/quality control procedures, including detection limits being used, shall be provided for EPA Region 9 approval.

3.2.2. Any potential variation or change in the designated laboratory or analytical procedures shall be reported, in writing, for EPA Region 9 approval.

3.2.3. EPA Region 9 may require analyses of quality control samples by any laboratories employed for purposes of compliance with Special Condition 3.1 and Appendix A. Upon request, the permittee shall provide EPA Region 9 with the analytical results from such samples.

3.2.4. A complete analysis of constituents, required in Special Condition 3.1, shall be made by the permittee and reported to EPA Region 9 and the EQC whenever there is a change in the quality of the waste, process configuration, or waste treatment. If deemed necessary by EPA Region 9, bioassays shall be required in addition to constituent analyses.

3.3. <u>Reporting</u>

3.3.1. Each permittee shall provide EPA Region 9 and the EQC with a report for each month of the permit containing:

3.3.1.1. Daily volumes, reported in gallons/day, of each waste material removed from the permittees' facilities;

3.3.1.2. Monthly waste material analyses demonstrating that the waste materials being dumped comply with the permitted limits of constituents listed in Special Condition 2.4;

3.3.1.3. Monthly analyses of the additional parameters listed in Special Condition 3.1,

3.3.1.4. The monthly amount of coagulant polymer and alum added to the waste streams; and

3.3.2. Such reports shall be submitted to EPA Region 9 and the EQC within 45 days of the end of the preceding month for which they were prepared. The reports shall be submitted within this 45 day period unless extenuating circumstances, communicated to EPA Region 9 and the EQC in writing and approved by the agencies, necessitate a delay in reporting.

3.3.3. A summary report of all monthly reports listed in Special Condition 3.3.1, including a statistical analysis of parameter variability and a detailed discussion of the results of the monthly reports, shall be submitted by each permittee to EPA and the EQC 45 days after the permit expires.

3.3.4. Upon detection of a violation of any permit limitations, the permittee shall send a written notification of this violation to EPA Region 9 and the EQC within five working days and a detailed written report of the violation shall be sent to the agencies within 15 working days.

4. SPECIAL CONDITIONS - VESSEL OPERATIONS

Specification of vessel operations is required to limit dumping activities to the dump site identified in Special Condition 2.2 and to record all activities that occur at sea.

4.1. Posting of the Permit

This permit, or a true copy thereof, shall be placed in a conspicuous place on any vessel which will be used for the transportation and dumping authorized by this permit. If the dumping vessel is an unmanned barge, the permit or true copy of the permit shall be transferred to the towing vessel.

4.2. Vessel Identification

Every vessel engaged in the transportation of wastes for ocean disposal shall have its name and number painted in letters and numbers at least four inches high on both sides of the vessel. The name and number shall be kept distinctly legible at all times, and a vessel without such markings shall not be used to transport or dump waste material.

4.3. Disposal Rate and Vessel Speed

The disposal vessel/barge shall discharge the material authorized by this permit beginning near the center of the disposal site identified in Special Condition 2.2. The disposal operation shall be conducted at a rate of 140 gallons per minute per knot, not to exceed 1400 gallons per minute at a maximum speed of 10 knots, while moving in a circle with a radius less than or equal to 0.2 nautical miles.

4.4. Navigational Equipment

The permittees shall employ an onboard electronic positioning system (see reference below) to accurately fix the position of the disposal vessel during all dumping operations. This system is subject to advanced approval by EPA Region 9 and the U.S. Coast Guard Liaison Office (CGLO) Pago Pago 15 days after the effective date of the permit.

Environmental Protection Agency. 1987. Evaluation of survey positioning methods for nearshore marine and estuarine waters. Office of Marine and Estuarine Protection, Washington, D.C. EPA 430/9-86-003.

4.5. Permitted Times for Disposal Operations

Dumping operations shall be restricted to daylight hours, unless an emergency exists and written authorization is obtained from the CGLO Pago Pago or the EQC prior to departure. EPA Region 9 shall be notified no later than five working days after the emergency in a written report of the situation.

4.6. Reporting of the Ocean Dumping Vessel Operations

4.6.1. The waste transporter shall maintain and the permittees shall submit copies of a monthly transportation and dumping logbook, including plots of all relevant information requested in Special Condition 4.6.2, to EPA Region 9, CGLO Pago Pago, and the EQC within 45 days of the end of the preceding month for which they were prepared. The report shall be submitted within this 45 day period unless extenuating circumstances, communicated to EPA Region 9 and the EQC in a writing and approved by the agencies, necessitates a delay in reporting.

4.6.2. The logbook shall contain the following information for each waste disposal trip:

4.6.2.1. Permit number, date and serial trip number;

4.6.2.2. The time that loading of the vessel commences and ceases;

4.6.2.3. The time and navigational position that dumping commences and ceases;

4.6.2.4. A record of vessel speed and direction every 15 minutes during each dumping operation at the disposal site, and a plot on a navigational chart of the vessel's course;

4.6.2.5. Observe, note and plot the time and position of any flotable material;

4.6.2.6. Observe, note and plot the wind speed and direction every 30 minutes;

4.6.2.7. Observe and note wave height at the beginning and end of the disposal trip;

4.6.2.8. Observe, note and plot any unusual occurrences during the disposal trip; and

4.6.2.9. Observe, note and plot any other information relevant to the assessment of environmental impacts as a result of dumping activities.

5. SPECIAL CONDITIONS - DUMP SITE MONITORING

The monitoring program for disposal of wastes in the ocean must document short- and long-term effects of disposed wastes on the receiving waters, biota, and beneficial uses of the receiving waters; and determine compliance with permit terms and conditions. Once an adequate background database is established and predictable relationships among biological and physical variables are demonstrated, it may be appropriate to revise the monitoring program. Revisions may be made under the direction of EPA Region 9 at any time during the permit term, in compliance with 40 CFR 223.2 and 223.3. This may include a reduction or increase in the number or parameters to be monitored, the frequency of monitoring, the location of sample stations, or the number and size of samples to be collected.

5.1. Monitoring Program

The permittees are required to implement the EPA Region 9-specified monitoring program defined in Appendix A as a means of determining the environmental impacts of ocean dumping of the waste. Monitoring cruises shall be scheduled within the first two weeks of each month, if possible, to allow enough time for laboratory analysis and report writing in compliance with Special Condition 5.2. Sampling days may be scheduled from Monday through Sunday. The permittees shall notify the EQC at least 24 hours prior to any scheduled monitoring activities.

5.2. Monitoring Reports

Monthly site monitoring reports shall be submitted to EPA Region 9 and the EQC within 60 days of the end of the preceding month for which the samples were taken. The reports shall be submitted within this 60-day time period unless extenuating circumstances, communicated to EPA Region 9 and the EQC in a writing and approved by the agencies, necessitate a delay in reporting.

The reports shall include: neatly compiled raw data for all sample analyses, a quality assurance/quality control package for the data, statistical analysis of sample variability between stations and within samples for appropriate parameters, and a discussion of the results.

5.3. Final Summary Report

5.3.1. A report summarizing all of the data collected during the waste material and dump site monitoring programs shall be submitted to EPA Region 9, the EQC, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service 60 days after the permit expires.

5.3.2. At a minimum, the summary report shall contain the following sections:

5.3.2.1. Introduction (including a brief summary of previous ocean disposal activities),

5.3.2.2. Location of Study Sites,

5.3.2.3. Materials and Methods,

5.3.2.4. Results and Discussion (including comparisons and contrasts with previous data related to disposal of fish processing wastes off American Samoa),

5.3.2.5. Conclusions,

5.3.2.6. References,

5.3.2.7. Raw Data Appendix, and

5.3.2.8. Quality Assurance/Quality Control Information.

5.4. Quality Assurance/Quality Control

5.4.1. All appropriate phases of the monitoring, sampling, and laboratory analytical procedures shall adhere to the EPA Region 9-specified protocols and references listed in Special Condition 3.1.4.

5.4.2. The qualifications of the on-site Principal Investigator in charge of the field monitoring operation at the dump site shall be submitted to EPA Region 9 and the EQC for approval prior to the initial monitoring cruise. Notification of any change in this individual shall be submitted EPA Region 9 and EQC- at least 7 days before the cruise is scheduled.

6. SPECIAL CONDITIONS - NOTICE TO REGULATORY AGENCIES

6.1. Notice of Sailing to U.S. Coast Guard

6.1.1. The waste transporter shall provide telephone notification of sailing to CGLO Pago Pago at 633-2299 or the EQC at 633-2304 during working hours (7:00 a.m. to 3:30 p.m.) no later than 24 hours prior to the estimated time of departure for the dump site designated in Special Condition 2.2.

6.1.2. The waste transporter shall immediately notify CGLO Pago Pago or the EQC upon any changes in the estimated time of departure greater than two hours.

6.1.3. Surveillance of activities at the dump site designated in Special Condition 2.2, may be accomplished by unannounced aerial overflights, a USCG shiprider and/or an EQC shiprider who will be on board the towing/conveyance vessel for the entire voyage. Within two hours after receipt of the initial notification the waste transporter will be advised as to whether or not a shiprider will be assigned to the MV Mataora.

6.1.4. The following information shall be provided to CGLO Pago Pago or the EQC in the above-mentioned notification of sailing:

6.1.4.1. The time of departure,

6.1.4.2. Estimated time of arrival at the dump site,

6.1.4.3. Estimated time of departure from the dump site, and

6.1.4.4. Estimated time of return to port.

6.2. Reports and Correspondence

6.2.1. Two copies of all reports and related correspondence required by General Condition 1.8, Special Conditions 3.1, 3.2, 3.3, 4.4, 4.5, 4.6, 5.2, 5.3, 5.4, and all other materials, including applications shall be submitted to EPA Region 9 at the following address:

Office of Pacific Island and Native American Programs (E-4)
U.S. Environmental Protection Agency, Region 9
215 Fremont Street
San Francisco, California 94105
Telephone (415) 974-7432

6.2.2. Two copies of all reports required by General Condition 1.8 and Special Conditions 4.4, 4.5, 4.6 and 6.1 sent to the U.S. Coast Guard shall be submitted to the following address:

Commanding Officer
U.S. Coast Guard Liaison Office
P.O. Box 249
Pago Pago, American Samoa 96799
Telephone 633-2299

6.2.3. Three copies of all reports required by General Condition 1.8 and Special Conditions 3.1, 3.2, 3.3, 4.4, 4.5, 4.6, 5.1, 5.2, 5.3 and 6.1 sent to the American Samoa Environmental Quality Commission shall be submitted to the following address:

Executive Secretary
American Samoa Environmental Quality Commission
Office of the Governor
Pago Pago, American Samoa 96799
Telephone 633-2304

6.2.4. One copy of the summary report required by Special Condition 5.3 shall be sent to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service at the following addresses:

Project Leader
Office of Environmental Services
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard
P.O. Box 50167
Honolulu, Hawaii 96850

Western Pacific Program Officer
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396

Signed this 12 day of September, 1988

For the Regional Administrator

Harry Seraydarian
Director
Water Management Division

APPENDIX A

STAR-KIST SAMOA AND SAMOA PACKING COMPANY
OCEAN DUMPING RESEARCH PERMIT OD 88-02
JOINT OCEAN DUMP SITE MONITORING PLAN

7. MONITORING OF RECEIVING WATER

Movement of the waste plume shall be tracked during each monitoring cruise by the use of a transmissometer. The results of the first monitoring report will be evaluated by EPA Region 9 to determine whether Sections 7.1 and/or 7.3 need to be refined. The evaluation will be based on documented sampling results and recommendations of the permittees.

7.1. Location of Water Sampling Stations

7.1.1. On each sampling cruise, the latitude and longitude of all sampling stations shall be determined using appropriate navigational equipment.

7.1.2. The Principal Investigator shall ensure that the transmissivity profiles and samples, taken at the location marked "X" (Figure 1) for each station, are positioned as close as possible to the middle of the discharge plume. The middle of the plume shall be determined visually by the Principal Investigator each time a profile or sample is to be taken. Other profiles or samples, taken at the locations marked "A, B, C and D" (Figure 1) for each station, shall be taken relative to the visually identified plume.

7.1.3. The following sample stations shall be occupied on each sampling cruise (see Figure 1):

7.1.3.1. Station 1X - 1.85 kilometers (1.0 nautical mile) up current of Station 2X to be used as the control station,

7.1.3.2. Station 2X - Center of the dumping operation,

7.1.3.3. Station 3 - Station 3X shall be sampled 30 minutes after Station 2x, with a transmittance profile at the visual plume centerline. Stations 3A and 3B shall be sampled as soon as possible after 3X, with the 3A profile 90° and the 3B profile 270° relative to Station 3X. Both 3A and 3B shall be within the plume 20 feet from the edge.

7.1.3.4. Station 4 - Station 4X shall be sampled 60 minutes after Station 2x, with a transmittance profile at the visual plume centerline. Stations 4A and 4B shall be sampled in the same manner as Stations 3A and 3B above.

7.1.3.5. Station 5 - Station 5X shall be sampled 120 minutes after Station 2x, with a transmittance profile at the visual plume centerline. Stations 5A and 5B shall be sampled in the same manner as Stations 3A and 3B above. Stations 5C and 5D shall be sampled as soon as possible after Station 5B. Stations 5C and 5D shall be aligned perpendicular to the centerline of the plume and one-half the distance between 5A and 5X or 5B and 5X, respectively.

7.1.3.6. Station 6 - Station 6X shall be sampled 180 minutes after Station 2x, with a transmittance profile at the visual plume centerline. Stations 6A, 6B, 6C and 6D shall be sampled in the same manner as Stations 5A through 5D described above.

7.1.3.7. Station 7 - Station 7X shall be sampled 240 minutes after Station 2x, with a transmittance profile at the visual plume centerline. Stations 7A, 7B, 7C and 7D shall be sampled in the same manner as Stations 5A through 5D described above.

Prevailing Surface Current Direction
<--------------------

A	A	A				
C	C	C	A	A		
7X	6X	5X	4X	3X	2X	1X
D	D	D	B	B		
B	B	B				
240'	180'	120'	60'	30'	Dump	Control Station

Figure 1. Orientation of Sample Stations (Top View) Relative to the Visual Plume Centerline at the Time of Sampling.

7.1.4. A transmittance profile shall be taken to a depth of 10 meters at Stations 3, 4, 5, and 6 with measurements recorded at depths of 1, 3, and 10 meters. Transmittance profiles shall be measured to a depth of 20 meters at Station 1, 2, and 7. Exact locations and time of sampling of each of the profiles to the 90° or 270° of the centerline at each station will be determined by using the "best professional judgment" of the Principal Investigator on the monitoring vessel.

7.1.5. Current speed and direction shall be determined at Stations 1X, 2X, and 7X by using an appropriate profiling current meter on each sampling cruise. Current speed and direction shall be measured and recorded at the following depths: 1, 3, 10, and 20 meters.

7.1.6. On each sampling cruise a water column profile to a depth of 20 meters for the following parameters shall be made at Stations 1X, 2X, and 7X using appropriate water column profiling equipment:

Parameter	Detection Limits
Dissolved Oxygen	0.1 mg/L
pH	0.1 pH units
Transmissivity	0.1 % transmittance
Secchi disk depth	1 foot

7.1.6.1 The profiles required in Section 7.1.6 shall be made to a depth of 20 meters with measurements at 1, 3, 10, and 20 meters.

7.1.6.2. Water column profiling equipment shall be calibrated before and after each survey to ensure high quality data collection.

7.1.7. Surface water conditions shall be recorded at all stations including:

7.1.7.1. Wind speed and direction;

7.1.7.2. Wave height; and

7.1.7.3. Observations of waste, color [e.g., Forel-Ule (FU) color scale, odor, floating materials, grease, oil, scum, foam or other floating materials attributed to fish wastes.

7.2. Water Column Characteristics to Be Measured

7.2.1. The limited permissible concentration (LPC) of the liquid phase of the waste material shall not be exceeded at the disposal site boundary four hours after disposal operations cease. The LPC is that concentration of the material which, after allowance for initial mixing as defined at 40 CFR 227.29, does not exceed applicable American Samoa Oceanic Water Quality Standards. EPA Region 9 and the EQC will evaluate the LPC based on EPA's Ocean Dumping Regulations and the water quality values obtained for the stations sampled during the tenure of this permit.

7.2.2. The following standards apply to American Samoa oceanic water:

Parameter	Median not to exceed given value	Not to exceed given value 10% of the time	Not to exceed given value 2% of the time
Turbidity (NTU)	0.20	0.29	0.36
Total Phosphorus (ug P/L)	11.00	23.00	35.00
Total Nitrogen (ug N/L)	115.00	180.00	230.00
Chlorophyll a (ug/L)	0.18	0.40	0.65
Light Penetration Depth (feet)	150*	132*	120*
Dissolved Oxygen (DO)	Not less than 80% of saturation or less than 5.5 mg/L. If the natural level of DO is less than 5.5 mg/L, then the natural DO shall become the standard.		
pH	The range shall be 6.5 to 8.6 pH units and within 0.2 pH units of that which would occur naturally.		

*To exceed the given value 50%, 90% and 98% of the time respectively.

7.2.3. Water column sampling depths for discrete samples collected Stations 1X, 2X and 7X shall be taken at 1, 3, 10 and 20 meters.

7.2.4. Water samples shall be obtained using self-closing 3-liter water sample device at each depth listed in 7.2.3.

7.2.5. Water column parameters analyzed from discrete samples taken at the depths listed in 7.2.3 shall include:

Parameters	Detection Limits
Total Suspended Solids	0.1 mg/L
Total Volatile Suspended Solids	0.1 mg/L
Total Phosphorus[a]	0.001 mg/L
Total Nitrogen[a]	0.001 mg/L
Ammonia[a]	0.001 mg/L

a = samples should be acidified to pH <2 with sulfuric acid and refrigerated a $4^{\circ}C$ until analysis.

7.2.6. If waste stream analyses, described in Special Condition 3.1, identify significantly high levels of constituents that may adversely affect marine water quality, EPA Region 9 may require that those constituents be added to the list of water column parameters in 7.2.5 above.

7.3. Frequency of Water Sampling Cruises and Station Sampling

7.3.1. Water samples and appropriate probe readings shall be collected when dumping operations are scheduled. Each station listed under Section 7.1 shall be sampled once each month. These samples shall be used to characterize the receiving waters at the disposal site.

7.3.2. The sample at Station 1X shall be taken prior to dumping activities.

7.3.3. Station 2X shall be sampled at a point within the plume immediately after discharge operations begin.

7.3.4. Stations 3X through 6X shall be sampled consecutively at intervals indicated in Section 7.1.3 to allow efficient sampling of the discharge plume.

7.3.5 Station 7X shall be sampled at a point within the plume four hours after discharge operations begin.

8. MONITORING OF BIOLOGICAL COMMUNITIES

8.1. Pelagic Resources

8.1.1. All sightings of fish, sea turtles, sea birds, or cetaceans near the disposal site shall be recorded including:

8.1.1.1. Time, location and bearing;

8.1.1.2. Species name(s); and

8.1.1.3. Approximate number of individuals.

RESPONSES TO COMMENTS RECEIVED ON THE DRAFT RESEARCH PERMIT OD 88-02 TO DISPOSE OF FISH CANNERY WASTES OFF AMERICAN SAMOA

<u>COMMENTOR 1.</u> Fred H. Avers, Chairman of the Board and Chief Executive Officer, Samoa Packing Company, Inc.

<u>Comment 1A.</u> The correct name of the waste transporter is Silk and Boyd.

<u>Response.</u> The name of the waste transporter has been corrected to Silk and Boyd.

<u>Comment 1B.</u> Use the OD 88-01 limits for the constituents in the DAF Sludge, Precooker Water and Press Water or develop new limits based on statistical analysis of actual summary data.

<u>Response.</u> The limits for the permitted maximum concentrations for DAF Sludge, Precooker Water, and Press Water have been modified to reflect the limits in the previous permit, OD 88-01.

<u>Comment 1C.</u> Allow monthly and summary reports to be submitted 45 days after the end of the preceding month. The 45 day time period was the time specified in permit OD 88-01.

<u>Response.</u> The submission times for the monthly and summary reports have been modified to 45 days as previously allowed by permit OD 88-01 (see Sections 3.3.2 and 3.3.3).

<u>COMMENTOR 2.</u> Jeffrey R. Naumann, Manager, Environmental Engineering, Star-Kist Foods, Inc.

<u>Comment 2A.</u> Request that the permitted maximum concentrations be increased to reflect the highest values for each parameter and in each waste which have been attained so far, since the canners have no direct control of the concentrations in the waste streams.

<u>Response.</u> The requested limits for permitted maximum concentrations for DAF Sludge, Precooker Water, and Press Water have been included and are the same as the limits in permit OD 88-01.

<u>Comment 2B.</u> Modify footnote "a" and delete footnote "b" at the bottom of Section 2.4.1 which is the table for the permitted physical and chemical constituents of the three cannery wastes to reflect that many of the higher values are from SAMPAC as well as Star-Kist.

Response. Footnote "a" has been modified appropriately, and footnote "b" has been deleted.

Comment 2C. Star-Kist notes that wording has been modified in Section 3. to require analysis of each waste stream even though they may not be ocean dumped under the permit. Request that this be deleted in that they see no purpose in including additional analyses of waste streams that have not been disposed of under the permit.

Response. The wording under Section 3. in draft permit OD 88-02 is the same as that in permit OD 88-01 which requires analysis of all material contained in the ocean dumping permit including DAF Sludge, Press Water, and Precooker Water. Section 3. has been modified to more clearly indicate this.

Comment 2D. Clarify the requirement to test total solids and total volatile solids, or total suspended solids and total volatile suspended solids.

Response. The tests required have been corrected to include total solids and total volatile solids (see Sections 3.1.2 and 7.2.5).

Comment 2E. Change the time for the submission of monthly reports and summary reports to 45 days due to practical problems related to sampling, laboratory analysis, and report preparation.

Response. See response to Comment 1C.

Comment 2F. Change the fourth line of Section 5.1 to read "... Monitoring cruises shall be scheduled within the first two weeks of each month, if possible, to allow enough time for laboratory analyses and report writing in compliance ...". This request is based on potential problems with weather and other factors that may force rescheduling at a more convenient time.

Response. This change is acceptable to EPA (see Section 5.1).

Comment 2G. Allow monitoring reports and final summary reports to be submitted 60 days after the end of the preceding month instead of 30 days.

Response. If a 60 day period will allow the permittees to send required reports (with all required test results) to the regulatory agencies on a more reliable schedule, then EPA will extend the time to 60 days (see Sections 5.2 and 5.3.1). Failure to meet this new time limit for reports will be considered a permit violation subject to enforcement under the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1401 et seq.).

Comment 2H. The permit indicates that it will be effective for six months. This would make the expiration date March 12, 1989 and not February 12, 1989.

Response. The permit expiration date has been modified.

Comment 2I. Allow the submittal of the monthly transportation and dumping log books to be within 45 days after the preceding month instead of the 30 days previously permitted.

Response. This change is acceptable to EPA (see Section 4.6.1).